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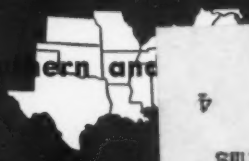

University Microfilms
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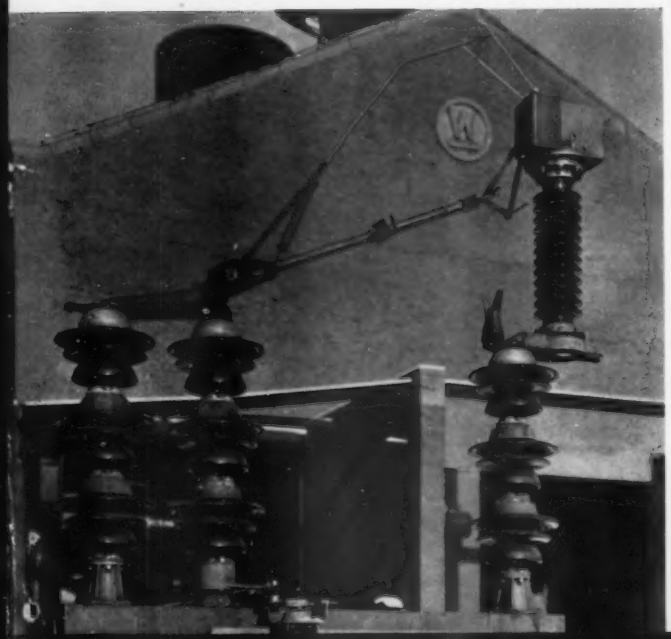
Contractor's apprentice training course ups company's efficiency—page 22

How to wire a machine shop with modern type wiring materials—page 24

Heat pumps prove advantageous for this modern Washington Church—page 26

Contractors contribute to Medallion Home Program success in Texas—page 28



Load break and grounding switches serve as breaker substitutes—page 46

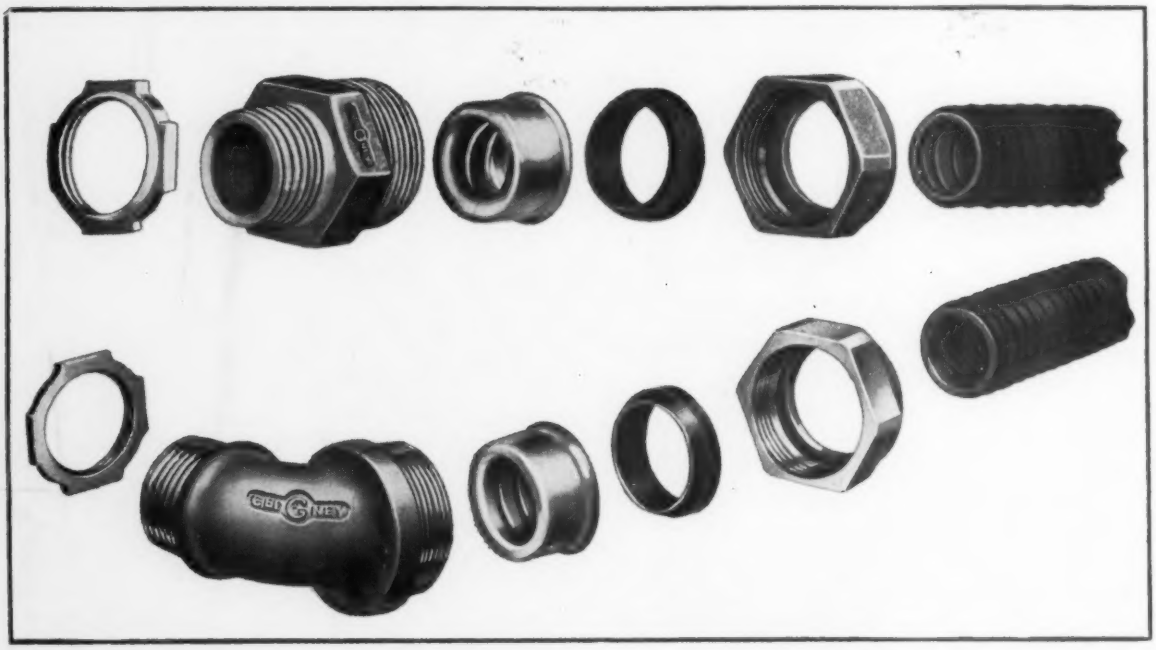
Protecting substation and line towers from rust and corrosion—page 50

Distribution transformer designed for residential U. G. service—page 51

Remote centralized control operates distribution capacitors—page 54

For absolutely Liquid-Tite Connectors specify

GEDNEY— every time!



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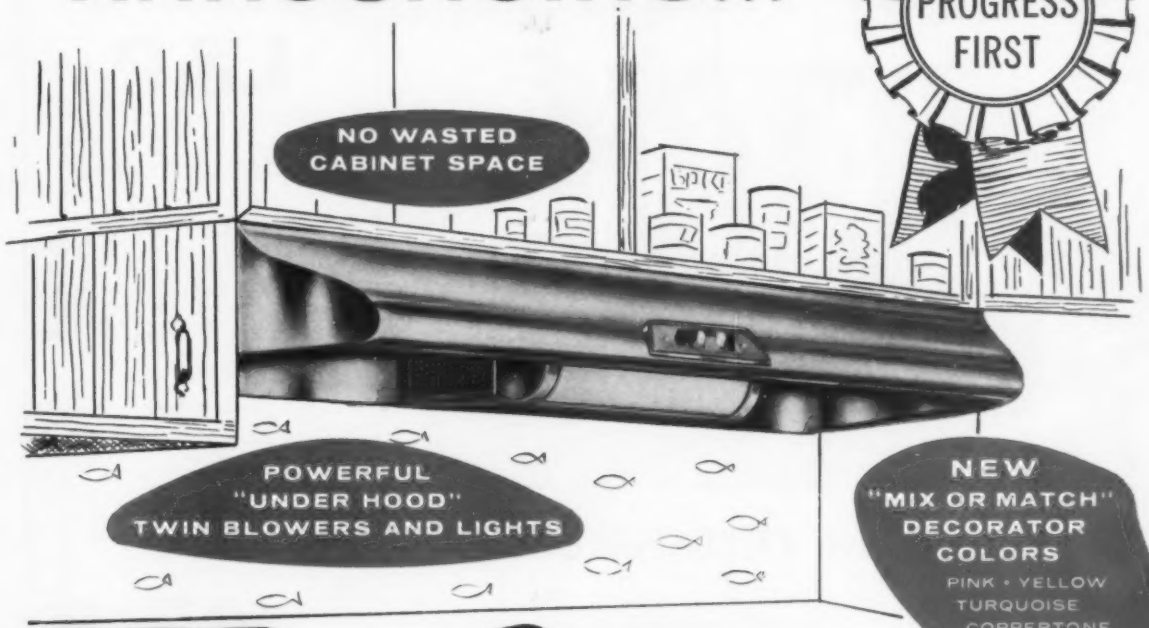

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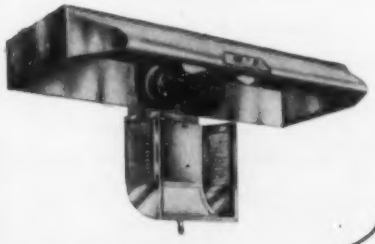

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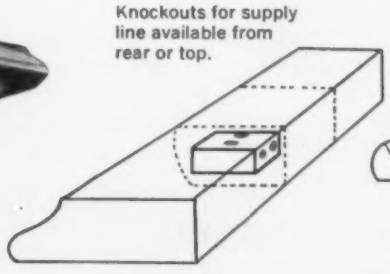

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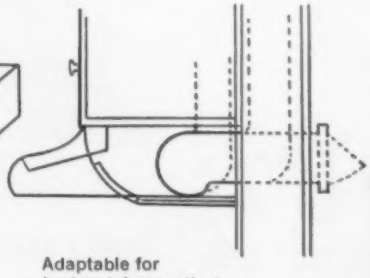

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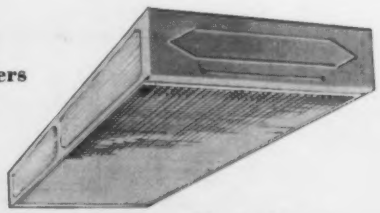

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In this issue

Well-planned apprentice training 22
How to wire a machine shop 24
Washington churches install heat pumps 26
Medallion Home program in Texas 28
Apartments wired for the future 30
Test board speeds maintenance work 32
Leg-saving device for contractors 34
Public Utilities of the Virginias meet 36

Utility engineering

Load break and grounding switches fill void 46
Protecting substation metal surfaces 50
Distribution transformers for underground 51
Meter by-pass eliminates interruptions 52
Transformers and breakers use same bushings 53
Remote control for distribution capacitors 54
New utility equipment 58

In every issue

Economic comment 3
Cartoon page 42
Data sheets 64
Contractors tell how 68
Understanding the code 70
News of the industry 76
News about people 85
Technical books 88
Bulletins and catalogs 89
New electrical products 90

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Economic comment

by J. Whitney Bunting, Ph.D.
Contributing Economics Editor

The continued upturn

The army of unemployed, still over some four million persons, will probably take little interest in the facts to be presented in this article, but there is little doubt but that recovery is well underway. Four million unemployed is still a serious matter and certainly indicates that the American economy is still not out of the "economic woods." However, this figure is considerably beneath the spring and early summer totals and thus is itself a harbinger of better times. Present indications point to a gradual, but steady, improvement in most economic factors until sometime in 1960 or 1961. Then, it is possible there may be further readjustment on the economic scene.

As the nation moves forward into the cool of autumn, with the advent of the normal holiday buying season not far off, the wholesalers and retailers continue to report a business activity more flourishing than that of 1957. Latest reports compiled by the Federal Reserve Board show that department stores across the nation reported sales in the week ending October 4 about seven per cent above the corresponding week of 1957. Added to this favorable statistic are the continued fine reports provided by a variety of consumer goods producers that the consumer buying decline has been weathered and that orders, in many cases, are well ahead of expectations. Buyers of washers, dryers, refrigerators, and even television sets have entered the markets in increasing numbers so that an era of good times seems reestablished.

Dr. Bunting is a well-known economist and educator having special knowledge of the South.

Weather even helps

Normally, there is an upsurge of consumer buying when the cool, nippy weather of autumn descends across the nation. Last year in most regions, the first frost was delayed so that there was little time between the start of cool weather and the holiday season. The conflict between the two probably restricted some consumer activity although retailers reported unusually good volume. This year, weather reports indicate that the first heavy frosts have already hit some areas and should be expected in other more temperate regions within the next few weeks. These frosts appear to be occurring about a month ahead of last year and about two weeks ahead of normal frost dates. Thus, there is little danger of a conflict between the cool weather and holiday buying periods. Even the weather may be helping the recovery picture.

The influence of weather has its greatest impact upon the apparel industry, and when cool weather is first felt by the consumer, he tends to scan his wardrobe and that of his family. Immediate steps are then taken to plug loopholes, and this requires purchasing in most instances. Fashion conscious women also use this season to "get in style" with the new "modes" on display. Children, of course, have already returned to school, but whereas the first few weeks can be covered by continued use of summer outfits, cool weather brings a need for heavier attire. The latter, that was useful last year, now no longer fits the growing young frame. Thus, the whole family becomes a consumer group for the apparel industry. This is what has sparked the early increase in sales in this field.

The automobile industry now has the worst of its strike problems over, but it is not all clear sailing as yet. There are many local stoppages stimulated by single plant grievances that still plague the big automobile manufacturers. Although many of the new car models have now seen the light of day, and although early reports show a better than average demand for some models, production lags have kept deliveries down. It is doubtful if the full impact of a bright automotive year will be felt until the first quarter of 1959. Suppliers of materials and components to the automotive manufacturers will, of course, see pickups in business due to the growing production schedules of the major producers.

The upturn curve

The normal pattern of recovery from a recession or depression period can usually be plotted by the use of a "U" shape curve. The trough of the curve may be broad or narrow depending upon the seriousness of the depression period and the difficulties encountered in producing an upturn. It was generally assumed some months ago that the trough of the present curve might extend for six months to a year, during 1958 and a part of 1959. It now is reasonably safe to believe that the recovery may be so rapid that the trough will consist of a jagged point with the upturn moving at a fairly rapid pace. Thus, the recession of 1958 may be portrayed graphically by the letter "V" rather than "U". Observers contend that only a strong economy, complete with consumer confidence, could have produced this condition.

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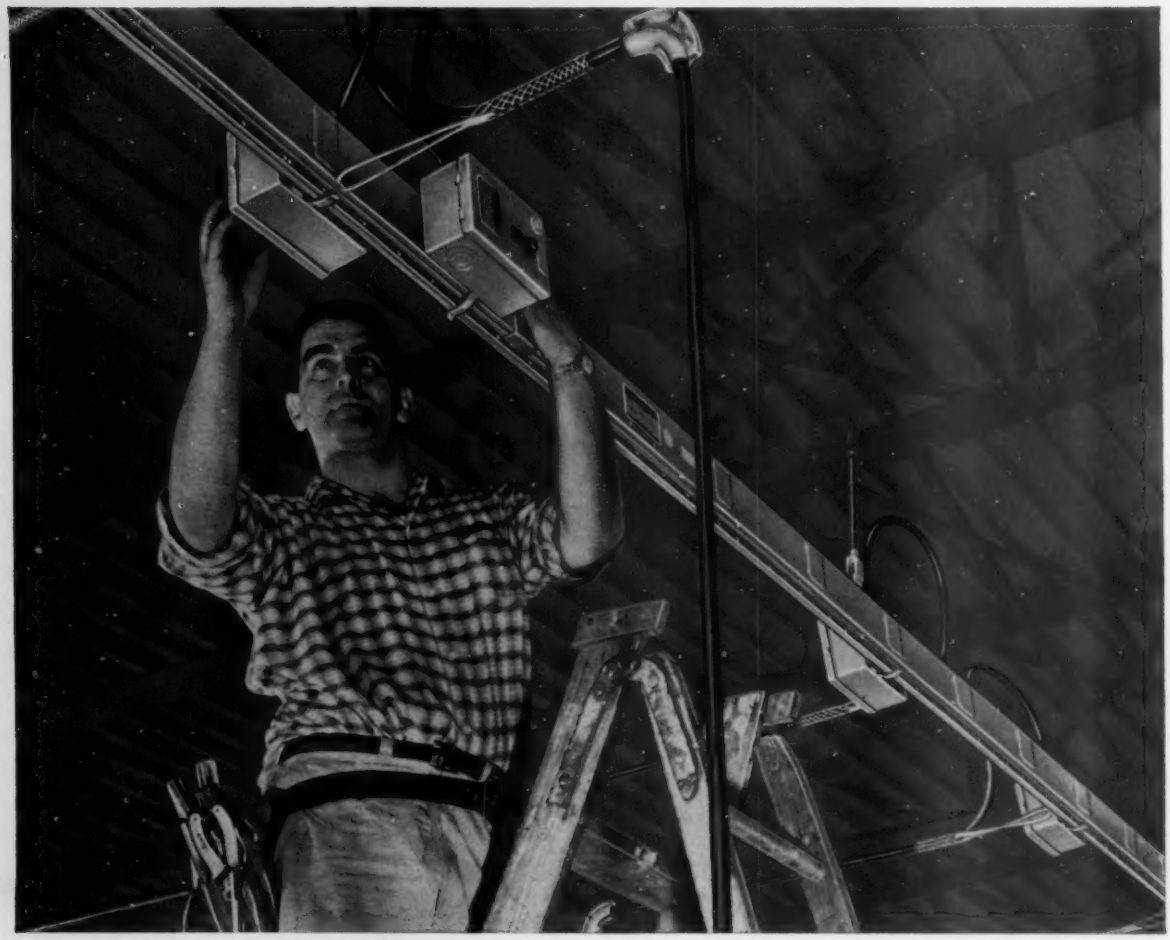

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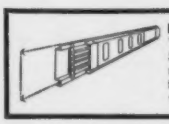

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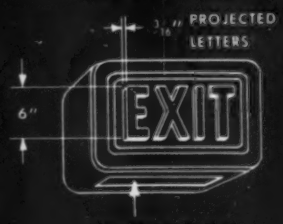

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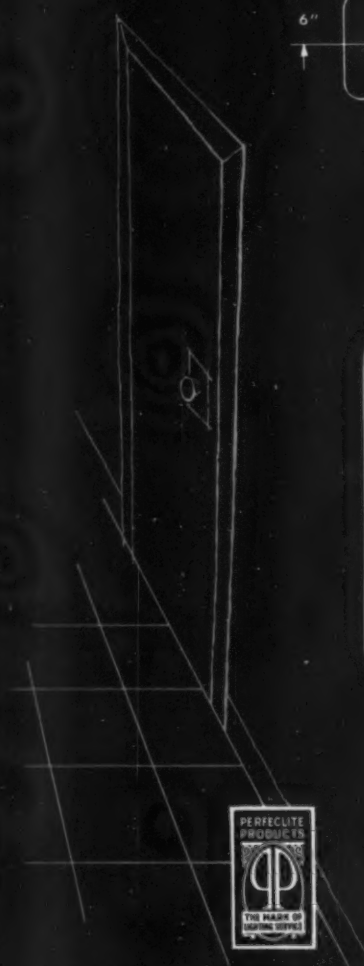

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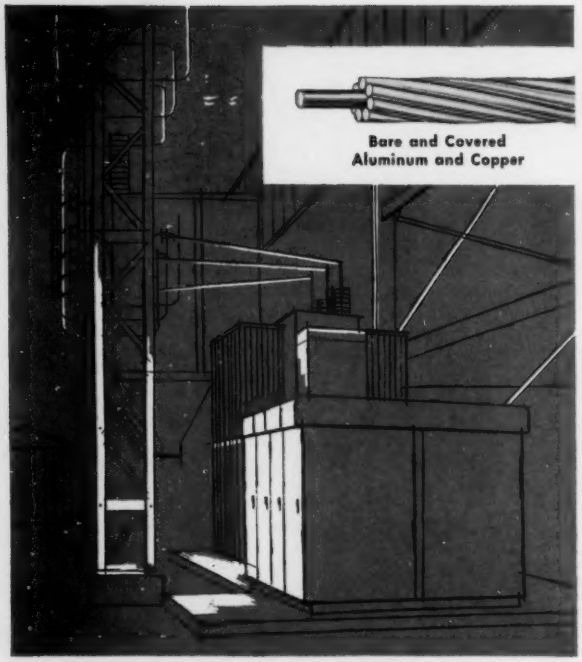

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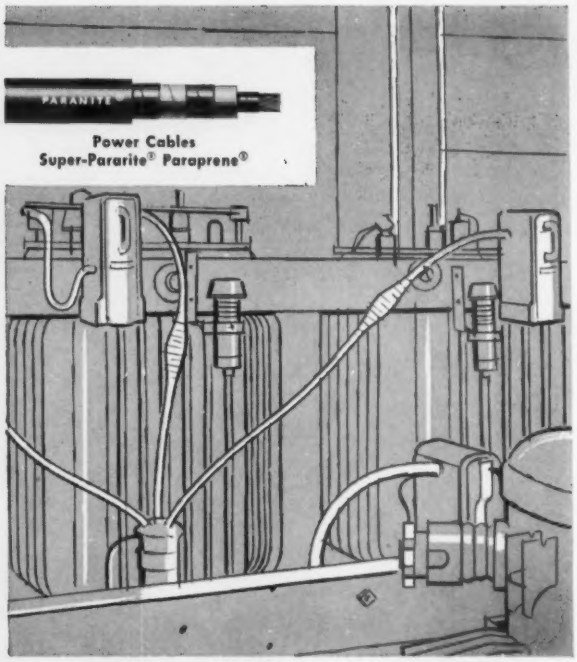

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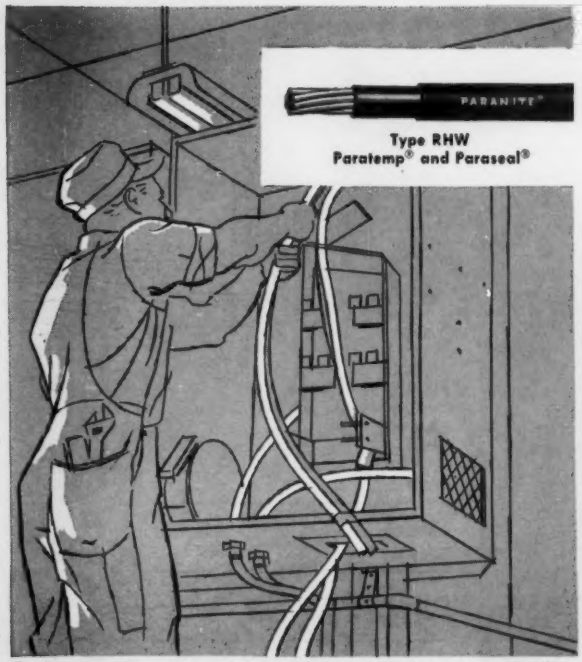

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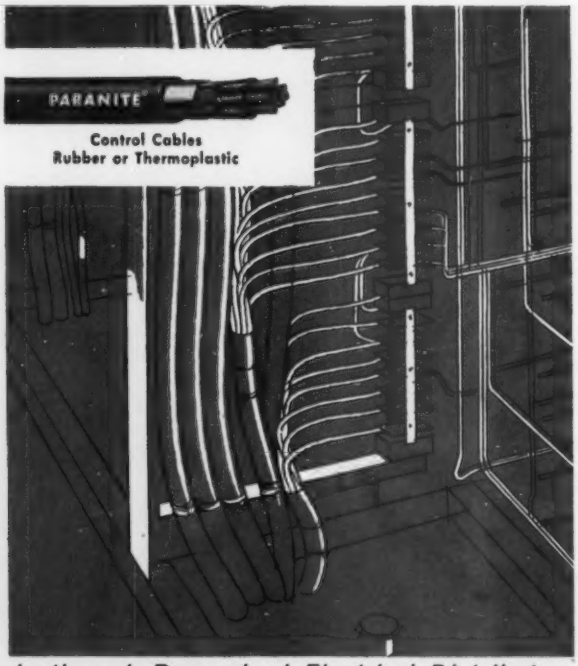

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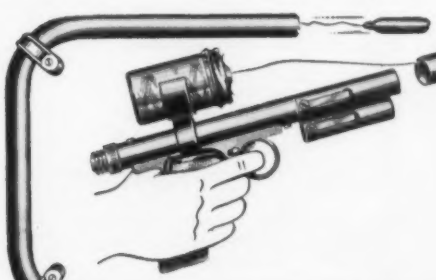

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Their more efficient design means *new savings in installation time and labor!*

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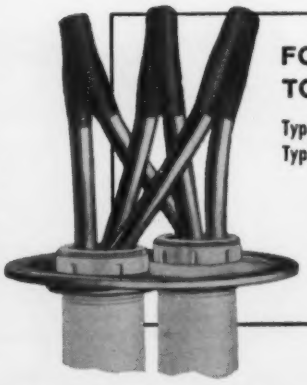
Still, with all their features, the new O.Z. Pull-n-Splice Boxes are *smaller* — and cost *far less* than conventional pull boxes . . . even late model *competitive* types! And, you get a bonus in high quality materials and workmanship so characteristic of *all* O.Z. products!

For complete information on these and the many other O.Z. products that mean more for you, call your local O.Z. distributor, or write to the company.



FOR VOLTAGES TO 5000 v.

Type "YPW" — Weatherproof
Type "YPE" — Explosion-proof

Deeper dome than "YCW" and "YCE". Furnished without connector panels. Insulated pigtail splices recommended.

O.Z. ELECTRICAL MANUFACTURING CO., INC.
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- CAST IRON BOXES
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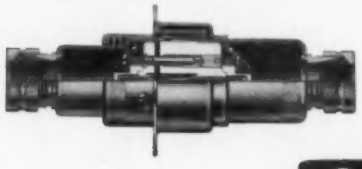
Industry's most adaptable—most versatile general duty plug and receptacle line . . . for power, control, electronic and thermocouple circuits in U/L circuit breaking ratings up to 20 amperes 250 volts, D.C.—460 volts, A.C.

IMPROVED TRIPLOC® CONNECTORS



Pyle-National's Triploc is the finest line of connectors on the market today, in its electrical rating and general application class. In the Triploc compact size and price range, no other connector can approach its rugged construction for industrial service . . . or equal the hundreds of optional shell assembly combinations possible with the standard 1 to 12 pole interchangeable and reversible contact inserts. Combinations up to 48 poles are easily assembled in enlarged shells which gang 2, 3 and 4 standard inserts. Water-tight shells also 2-wire and 3-wire fusible plugs are available.

New, Enlarged Wiring Space. Triploc's cadmium plated, pressed steel shells are of strong, low-weight design and provide ample wire terminating space for all inserts.

Self-Locking Triploc Plugs are available with automatic cord-strain release or with manual twist release only.

Wide Choice of Wire Terminals. Contact inserts are available with binding screw terminals—back wired, side wired, or pressure eyelet type; solder well type; crimp type.

Midget Triploc Round Prong Series is available in 2, 3 and 4-pole ratings of 20 amperes, 125 volts A.C.; 15 amperes, 125 volts D.C.; 10 amperes, 277 volts A.C.

SINCE 1897

THE PYLE-NATIONAL COMPANY

Sold nationally through authorized distributors. Write for bulletin 1252-B-C.

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CATALOGS and BULLETINS

Available Free to Readers of Electrical South upon Request

1011—Electrical Conduits

"Natural Electric Conduits" is the title of the 30-page Catalog No. 603 which describes and illustrates the many types of electrical conduits that are manufactured by National Electric Products Corp., 2 Gateway Center, Pittsburgh 22, Pa.

1015—Squeezon Connectors

The Squeezon, a new compression connector for power lines, is fully described in bulletin "SQ" available from the James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo. The Squeezon features greatly increased electrical and mechanical efficiency.

1019—Service Panels

Information on protective electrical control centers for homes, apartment buildings, service stations, and industrial applications is contained in Bulletin PM-385, "BullDog Pushmatic Electric-Centers," issued by BullDog Electric Products Co., 7610 Jos Campau, Detroit, Mich.

1097—Cord Catalog

A complete 48-page catalog is available from the Cornish Wire Co., 50 Church St., New York 7, N. Y. containing all data on flexible and portable cords, lamp cords, heater cords, cordsets, radio and electronic wires.

1103—Connectors

Comprehensive, up-to-date information on electrical connections for overhead lines in transmission and distribution is now available in one convenient publication, a 100-page manual issued by Burndy Corp., Norwalk, Conn., on connection techniques, connectors, and installation tooling.

1109—Anchoring Devices

An illustrated 32-page catalog, No. 65, describing more than 25 anchoring and drilling devices for making fastenings to masonry, is available from the Arro Expansion Bolt Co., Marion, Ohio.

1135—Wiring Devices

Catalog No. 56, and New Product Bulletins, containing the complete electrical wiring device line of Leviton Mfg. Co., Inc. Brooklyn 22, N. Y. Over 100-pages accurately illustrated and containing electrical and circuit wiring diagrams. Complete cross index for easy reference. Featured are Specification Grade Devices, Interchangeable line, Lev-O-Lock line, and many, many others; devices for every possible need and use in Industrial, Commercial and Residential applications.

1197—Convenience Outlets

Bulletin gives complete information on the new P&S No. 500 for adding extra outlets to existing installations. Everything you need in a single package—no steel boxes required. Available from Pass & Seymour, Inc., Dept. ES, Syracuse 9, N. Y.

1209—Fluorescent Ballasts

Advance Transformer Co., 2950 N. Western Ave., Chicago 18, Ill., has recently completed the compilation and printing of a 20-page catalog on fluorescent ballasts and their use. Included are data sheets on available Advance ballasts and a comprehensive installation and operation section and testing procedures. Copies of the booklet are available on request.

1211—Fluorescent Fixtures

Catalog folder No. 911, "Peerlite by Guth," has been announced by the Edwin F. Guth Co., 2615 Washington Blvd., St. Louis 3, Mo. Copies of this new eight-page booklet are available from the company upon request. The booklet is designed for the lighting specialist, giving complete engineering data and dimensions.

ELECTRICAL SOUTH
806 Peachtree St., NE
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November, 1958

Gentlemen:

Please send me the bulletins and catalogs indicated.

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1109	1135	1197	1209	1211
1219	1223	1227	1229	1233
1237	1245	1251	1253	1257
1259	1263	1265	1267	1269
1271	1273	1275	1277	1279
1281				

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- **QUICK-MAKE, QUICK-BREAK**
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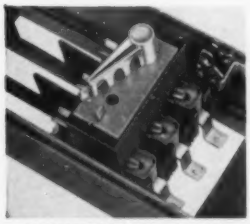
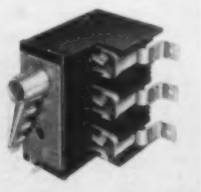
- **VISIBLE BLADE CONSTRUCTION**

FOR PANELBOARDS, SWITCHBOARDS, CONTROL CENTERS—heavy-duty design meets modern industry's increased power handling requirements—30 through 1200 amperes, 600 volts—the most complete line available! U.L. approved. For complete information on QMQB units and panelboards, write for bulletin 3-230: Federal Pacific Electric Company, General Offices: Newark, New Jersey.



VISIBLE BLADES FOR MAXIMUM SAFETY—Lets you see at a glance whether switch is "ON" or "OFF"—makes inspection easy. Silver-alloy contacts insure positive connections—reduce wattage loss.



INTEGRAL HANDLE MECHANISM FOR GREATER CONVENIENCE—handle mechanism and switch are combined in a single unit—eliminates excess linkage—prevents misalignment and false indication of switch position.

DEIONIZING ARC QUENCHERS FOR COOLER, FASTER INTERRUPTION—eliminate pitting and provide higher interrupting ability. Arc is divided, cooled, and extinguished in the quencher, rather than on the contact surfaces.

HIGH PRESSURE FUSE HOLDERS FOR LONG LIFE, RELIABLE SERVICE—grip the fuses tightly under constant spring pressure—reducing contact resistance for cooler, more efficient switch operation—even under varying loads.

LOCKING PROVISION FOR ADDED SAFETY—cover may be locked in either "ON" or "OFF" position with as many as three full-size padlocks to prevent unauthorized access. Additional provision for padlocking cover.

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The Best in Electrical Distribution and Control Equipment

START-STOP STATION with pilot. For surface mounting.
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SIZE 1 MAGNETIC STARTER with selector switch in cover.
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. . . **THEY'RE EASIER TO INSTALL AND MAINTAIN,** helping to make your work more profitable. And their added performance and dependability help build your business by insuring more satisfied customers.

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Act *now* to make your next job more profitable. Send today for your free 16-page booklet completely describing how to wire Arrow-Hart Motor Controls.

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ARROW AH HART

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MOTOR CONTROLS • ENCLOSED SWITCHES
APPLIANCE SWITCHES • WIRING DEVICES

Enter Code Numbers of Catalogs Desired on Coupon on page 12.

1219—Electrical Enclosures

Catalog No. 5354-U is a compact 94-page catalog describing the complete line of steel and aluminum electrical enclosures manufactured for utility use by the B & C Metal Stamping Co., 590 Means St., N. W., Atlanta, Ga. The catalog is well illustrated and contains complete specifications as well as prices on all items in the B & C line.

1223—Circuit Protection

A 24-page illustrated handbook contains suggestions for selecting the right kind of protection for electric circuits, motors, appliances and apparatus. Includes motor wiring diagrams and a complete list showing proper size fuses to use. Available from Bussman Mfg. Co., University at Jefferson, St. Louis 7, Mo.

1227—Conduit Fittings

A new complete 24-page catalog illustrating their complete line of conduit fittings and lighting parts for the electrical wholesaler has been made available by Elliott Electric Products Co., 1513 Olmstead Ave., New York 62, N. Y.

1229—Switch and Outlet Boxes

A new RACO General Catalog is now available listing detailed information on boxes, covers, and bar hangers. The catalog includes data on numbers of wires permitted per box and a list of comparative catalog numbers. Copy available from All-Steel Equipment, Inc., Aurora, Ill.

1233—Troffer Catalog

A 36-page catalog, with complete information on their newly re-designed architectural troffers has been released by Smithcraft Lighting Division, Chelsea, Mass. Divided into sections for selection of lighting units, the catalog gives complete illustrations and data for 1 and 2 foot troffers in all types of ceiling construction. Also included in the catalog is information on ceiling lighting patterns, shielding designs, lighting techniques and applications.

1237—Wireholders

Knox Porcelain Corporation, Knoxville 1, Tenn. has recently redesigned a one-piece metal base style reinforced wireholder, No. 5009. Base and screw are hot dipped galvanized. This wireholder has extra sharp threads and quick starting point to make driving easy. KNOX manufacturers a complete line of Porcelain Wireholders, House Brackets, Service Entrance Mast Kits and Accessories and other Secondary Service Materials.

Enter Code Numbers of Catalogs Desired on Coupon on page 12.

1253—Power Connectors

A completely new catalog (No. 526) of power connectors and bus support clamps is now available from Southern States Equipment Corp., Hampton, Ga., superseding catalog No. 525-R. Furnished in a handsome 7-ring binder, the new catalog includes sections on bus support clamps, couplers and angle braces, bar connectors, Tee connectors, stud connectors, ground connectors, parallel clamps, and terminals.

1257—Centrifugal Roof Ventilators

An 8-page, two-color folder (SDA-220) giving construction features, performance data, dicensions and recommended specifications for the new Centrifugal Roof Ventilator manufactured by The Peerless Electric Company, Warren, Ohio. Other important Peerless Fan and Blower products and a lis of Peerless sales representatives are also included.

1259—Electrical Tapes

Twelve pages of specifications and application data make up an ottractive booklet on Dutch Brand Electrical Tapes. Plastic, friction, and rubber tapes, as well as a vinyl tape made in nine different colors, are available from Dutch Brand Division, Johns-Manville, 7800 So. Woodlawn Ave., Chicago 19, Ill.

1263—Conduit Fittings

Bridgeport Fittings, Inc., 209 Center St., Bridgeport, Conn., offers a twenty-six page catalog describing their line of conduit, bushings, lock nuts, couplings, nipples, supports, connectors, and other fittings. Size, weight, and packaging details are included.

1265—Wire and Cable

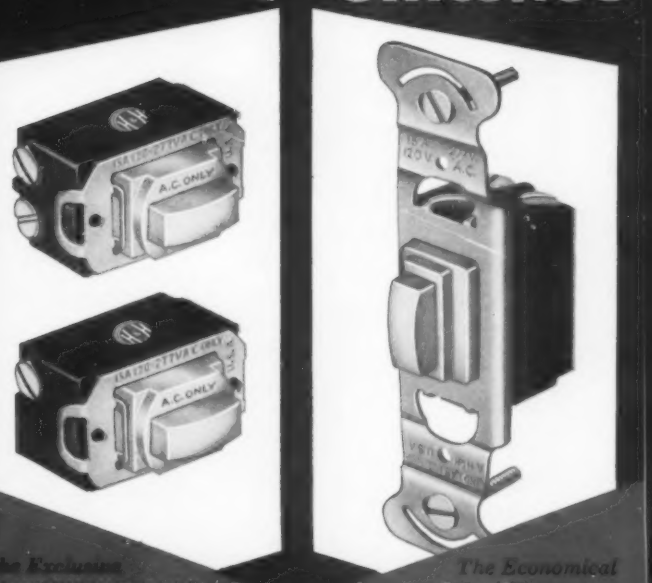
Simplex Wire & Cable Co. announces a new catalogue of the family of ANHYDREX insulated cables. Catalogue No. 1028, which supersedes Nos. 1017 and 1018, is available on request from Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

1267—Guy Strand

An Engineering Data Sheet—E. D. 1878—describing the new Copperweld Type M Guy Strand. Contains table of physical properties as well as instructions for dead-ending this new high-strength, non-rusting guy strand. Available from Copperweld Steel Company, Frick Building, Pittsburgh 19, Pa.

ARROW AH HART

With these TWO New Quiette® switches



The Exclusive INTERCHANGEABLE
15 or 20 Amps, 120-277 Volts, AC Only.

The Economical Junior
15 Amps, 120-277 Volts, AC Only.

Specification Grade H&H

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...ARROW-HART Now Offers You the ONLY Complete Line of Quiet Tap Action Switches Anywhere!

All three switches in this complete line — the compact and inexpensive new *Junior*, the versatile new *Interchangeable* produced *ONLY* by Arrow-Hart — and the built-for-a-lifetime Senior — tap on or off with the gentlest pressure of fingertip, hand or elbow anywhere on the button. All feature quiet mechanical action, operate on full voltage without relays, and provide safe control for incandescent or fluorescent lights . . . and for household appliances. Designed to effect important space savings that assure ease of wiring . . . and to provide electrical convenience at its finest . . . they are truly tomorrow's switches available *today!*

FOR FULL INFORMATION . . . *on the complete A-H line of Quiette Tap Action Switches, write today for your free copy of Booklet No. A-242.*

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Enter Code Numbers of Catalogs Desired on Coupon on page 12.

1269—Hydraulic Power

A new bulletin describing the two-speed, fast-approach portable power for hydraulic tools obtainable from hydraulic power pumps is offered by Greenlee Tool Co., of Rockford, Ill.

1271—Power-Strut Channel

Three new bulletins have been issued containing specifications and application data on Power-Strut channels and related devices manufactured by Power-Strut, Inc., Framingham, Mass. No. 550 describes its use as surface raceway and lighting support; No. 560, electrical cable and duct supports; 580, movable Power-Strut walls.

1273—Ventilators and Range Hoods

The Ventrola Mfg. Co., Owosso, Michigan, has available a new 12 page catalog describing in detail their entire line of Ventilators (both kitchen and bathroom) and Push-button range hoods. Installation instruction sheets of all models are also available.

1275—Wiring Devices

A complete new catalog of wiring devices is now available from Bell Electric Co., 5735 S. Claremont Ave., Chicago 36, Ill. The line includes a wide range of weatherproof receptacles and switches, portable garden lights, wall plates, and specialty items.

1277—Lighting Fixtures

A new completely detailed Catalog showing the latest in Indoor and Outdoor Lighting and Luminous Ceilings available from STA-BRITE FLUORESCENT MFG. COMPANY, Box 291, Riverside Sta., Miami, Fla.

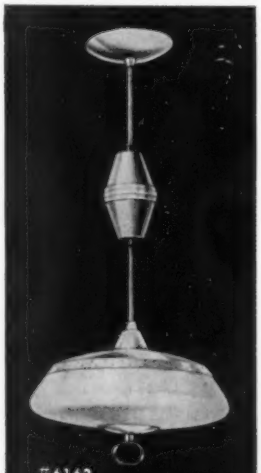
1279—Plug-In Reelite

Complete details about Appleton's lightweight, portable automatic Reelites are given in an attractive 4-page catalog insert. These devices find application in a wide range of occupancies: garages, loading docks, garment industry, construction crews, warehouses, machine shops, etc. Write to Appleton Electric Co., 1701 Wellington Ave., Chicago 13, Ill.

1281—Connectors

Five new bulletins have just been released by Ilsco Corp., 4730 Madison Rd., Cincinnati, Ohio. They cover the Ilsco line of solderless connectors, special connectors, lugs, netural bars, and the Ilsco Lok-Blok. The bulletins include descriptive material, dimensions, and packaging data.

EJS INTERNATIONAL

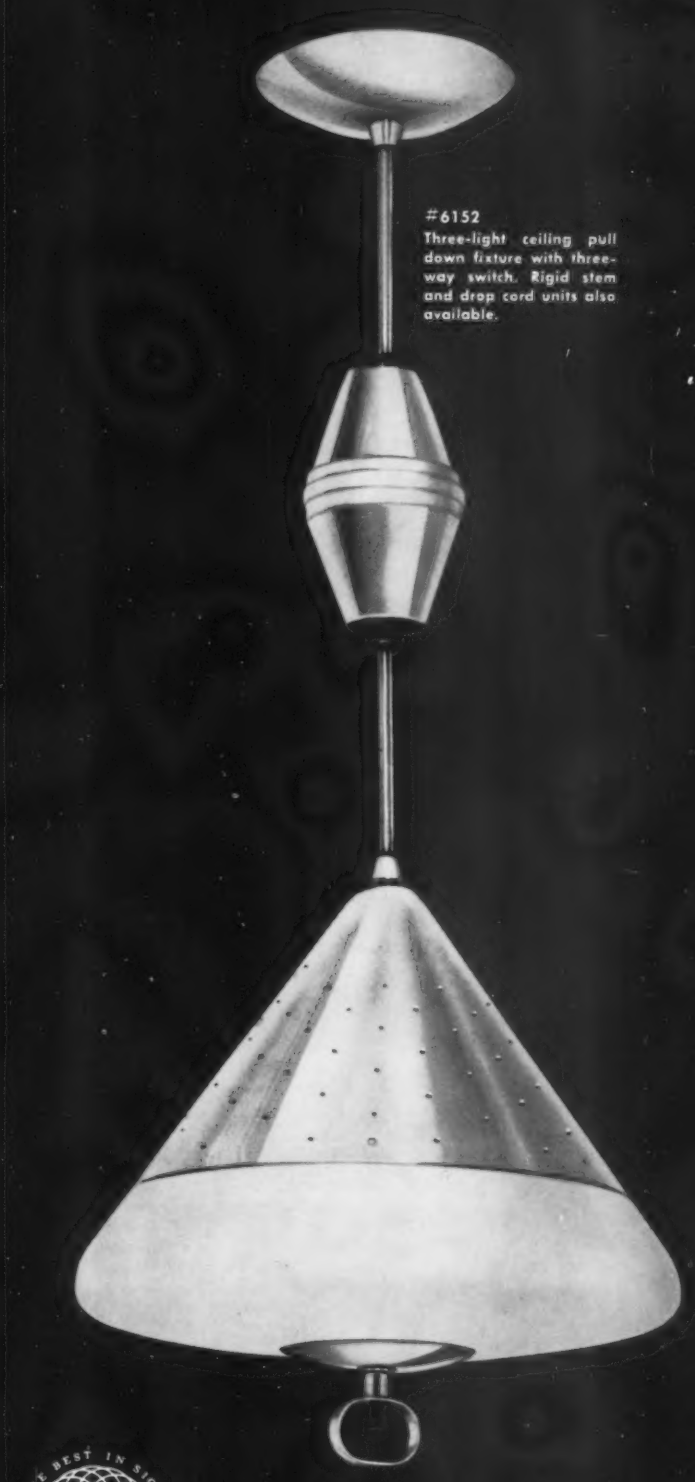


#6162
Three-light ceiling pull down fixture with three-way switch. Rigid stem and drop cord units also available.

An exciting blending of imported satin textured triplex blown glass and heavy, hand-spun aluminum . . . EJS International is an original masterpiece created by one of America's foremost designers combining all the manufacturing skill of EJS with old world craftsmanship in hand blown glass.

Its transitional design complements all lines of decor and interior styling. The extensive glass surface area distributes the light evenly, giving full, eye-pleasing illumination with no dark spots. The reflector is finished inside in non-glare white, outside with your choice of 20 famous EJS "dura-bond" colors and metallic finishes . . . and integrated into the graceful flow of the overall design.

#6150 Four-light close-to-ceiling fixture for universal application. Exclusive EJS "key-slot" design for easy installation.



#6152
Three-light ceiling pull down fixture with three-way switch. Rigid stem and drop cord units also available.

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a style, size and finish for your every requirement.
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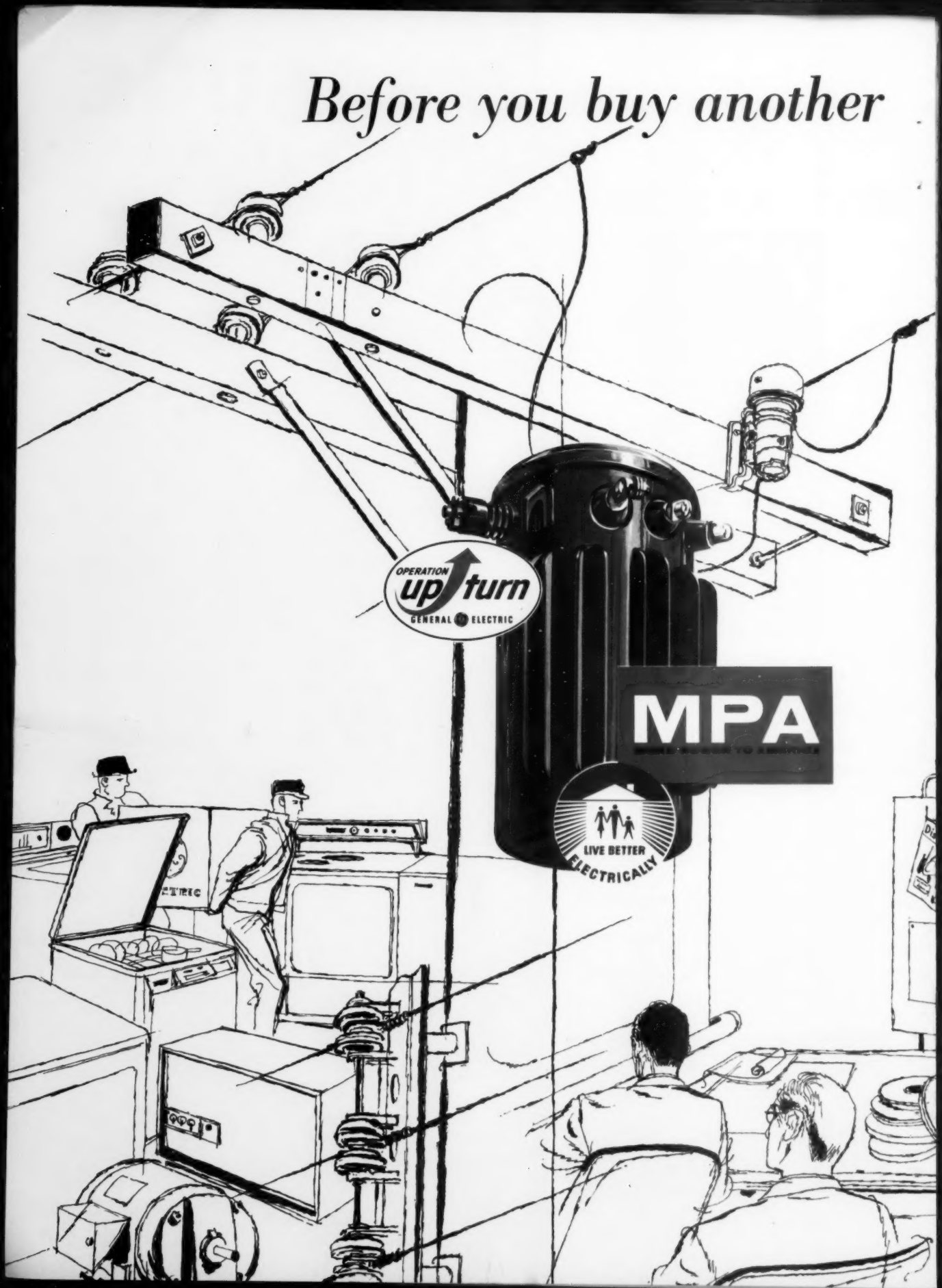
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For every distribution transformer you purchase from General Electric, almost a dollar is invested in More Power to America, Live Better Electrically, Operation Upturn, and in other industry-wide load-building and adequate-wiring programs.

General Electric sells two dollars' worth of equipment to *consume* electric power for every dollar's worth sold to *produce* electric power. And you get the load built by these power-consuming products, ranging from home appliances to giant furnaces for industry. So General Electric products as well as programs build load.

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		G.E.	OTHER MFGRS.			
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FILL IN THE BLANKS . . . See which manufacturer gives you more for your transformer dollar: Mark "X" for a measurable contribution, "O" for insignificant contribution.

ONLY T&B CONNECTORS

*for flexible liquid-tight conduit**

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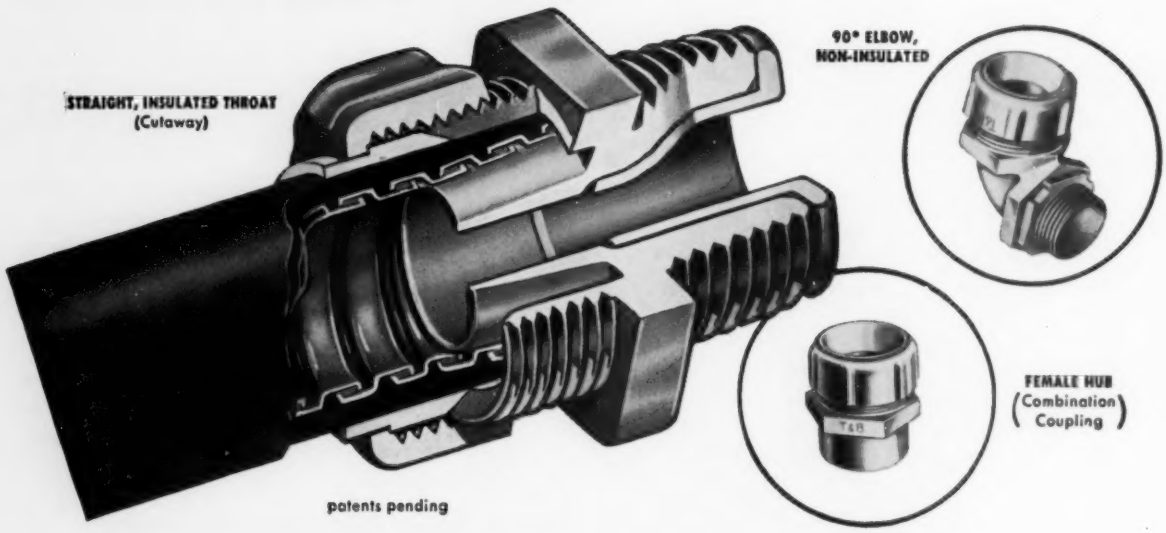


patents pending

THE T&B LINE provides a size range of ⅜" to 4" in the straight, 45° and 90° angle types . . . both insulated and non-insulated.

THE T&B LINE includes combination couplings from ⅜" to 1¼".

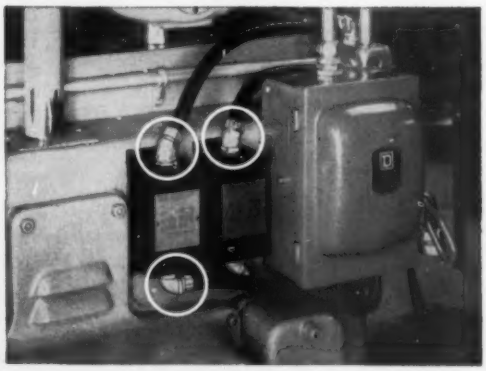
A T&B Liquid-Tight connection can't be half safe. The mechanical strength, continuity of ground, and oil seal are all interdependent. Each gives positive assurance that you have all three. And T&B's more compact design means easier installation and improved appearance.

Your T&B distributor has this complete line in stock. Be sure to ask for a demonstration . . . or write direct to T&B for detailed specifications.

* *Sealtite or equivalent*

THE T&B INSULATED LINE complies with all codes:

The National Electric Code (Paragraph 3736b)
J.I.C. Standards (Paragraphs 22.1.7 and 22.2.2)
Machine Tool Electrical Standards (Paragraph 22.1.7)



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IT'S THE MARK OF AN AUTHORIZED **T&B** DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

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THOMAS & BETTS, LTD., MONTREAL, P. Q., CANADA
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Up to 163 Degree Spread — Up to 236,000 Candlepower: Now in

New CROUSE-HINDS Mercury Floodlights

Plus 6 Outstanding Advantages Never Before Offered in Mercury Floodlights of this Wattage

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Mercury Floodlighting Is Here to Stay

No other floodlight lamp approaches mercury for long burning hours . . . for economy of cost and labor in relamping. And no other mercury floodlight approaches these new MVF's for convenience of relamping, aiming, utilization factor and maintenance of output over a long period of burning. Other lights in the Crouse-Hinds range of floodlights from 250 to 700 watts provide varying beam spreads, intensities and efficiencies.

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• TRAFFIC CONTROL SYSTEMS • AIRPORT LIGHTING and WEATHER MEASURING EQUIPMENT •

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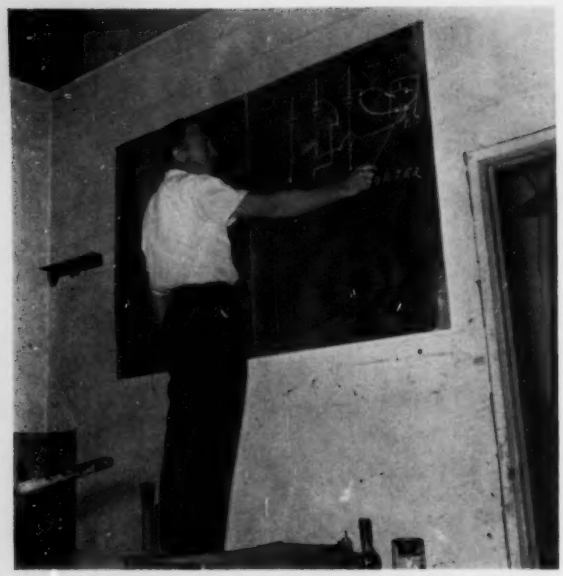


Harry R. Anderson before a class of journeymen and apprentices explains the function of a motor starter, pointing out the safety of a stop button.

Interviews with an apprentice take place periodically to encourage strong points in his performance and point out any possible weaknesses.

Quality contracting service begins with

By Harry R. Anderson

President
Anderson and Estabrook, Inc.
Arlington, Virginia

This article should be especially helpful to the following readers

- Electrical Contractors ✔
- Electric Utilities
- Electrical Wholesalers
- Electrical Inspectors ✔
- Industrial Engineers
- Consulting Engineers

◆ QUALITY SERVICE can come only from soundly trained mechanics. If quality service is to be maintained, only mechanics who have met high standards of performance through ability, attitude, stability, and application are a means to providing it. That is why we train our own mechanics. Achieving quality is a step-by-step, day-by-day process, where indoctrination on the merit of quality goes hand in hand with training on the job and in the classroom.

Training our own mechanics also gives us an opportunity of discovering special aptitudes and placing mechanics in the work they do most skillfully. There is also a special reward, an incentive to the very skillful who prove leaders with the ability to make decisions and carry responsibility, that of job leader with higher earnings. Our expansion depends on the number of these men who can qualify.

Though we retain only about 30 per cent of the mechanics we train, we believe the program more than pays off for the time, effort, and money put into it. Since contractors have only service to sell, that service, we believe, should be top quality, and our program is designed to meet that standard.

Importance of interview

We start out by looking for the man who wants to be a better-than-average mechanic. We select our material on the basis of personality, technical potential, and a desire to excel.

Preferring 20 to 30 year-old men who have had a high school education or the equivalent such as service training, we interview and evaluate on the basis of appearance, employment record, mechanical aptitude, interest in the field, ambition, domestic status, and financial stability. These aspects speak for themselves.

An applicant who has changed jobs frequently cannot achieve the skill of a steady and stable worker; a trainee who is harrassed by debts cannot give the concentration and application to new procedures in which he is being instructed; a trainee who is responsive, keenly interested, and aspiring can develop into excellent material, while the fellow who is negative, indifferent, and easy-going cannot. At the time of the initial interview, impressions are noted on a form while the applicant is evaluated.

We frequently draw our new personnel from the recommendations of employees already in our organization.

From the moment an applicant is taken on and through his six-month probation period, he is indoctrinated with the importance of a conscientious and skilful job. The criterion of his performance is quality. How hard he strives toward and achieves quality on a job determines whether or not he

Under the supervision of a journeyman, an apprentice learns the proper identification of wires at a main service installation in a laundry.

An apprentice is given a turn at the drafting board at Anderson and Estabrook so that the company may discover his abilities while training him well.

well planned apprentice training

is retained as an apprentice.

As a helper during this six-month period a young man is placed in the service department. He has a variety of duties: delivering materials to a job, helping in the sheet metal shop, handling materials, finishing, painting, grinding, drilling holes for screws. Largely he will do what someone tells him to. In monthly informal interviews with him, the shop superintendent or I discuss his future with him, point out his strong aptitudes, his weaknesses, the good and bad things about his work and attitude. As time goes on he learns what lies ahead if he is selected to remain for our 4-year apprenticeship program.

At the close of the six-month probation period we select the most promising men for the apprentice program. After being registered with the Virginia Apprenticeship Training Council, the new apprentice is assigned to journeyman mechanics who instruct, supervise, and answer questions as an apprentice moves from one job to another for a varied and well-rounded experience in electrical work. He gets his theory at an evening high school class once a week, and he supplements this with two 2½-hour classes each week in practical application and his on-the-job training.

Specialized instruction

Classes of specialized instruction given by a master electrician may be devoted to a study of the District of Columbia Code and the National Electrical Code, control wiring, functions of a motor starter, and analysis of two circuits—power and control.

There are classes in motor control, pushbuttons, thermostats, relays, and the disassembling and functioning of each part. Other classes are in the fundamentals, internal and external connections of transformers, circuit protection equipment, including circuit breakers of all types, and functions and circuit protection methods. A class is also taught in personal safety.

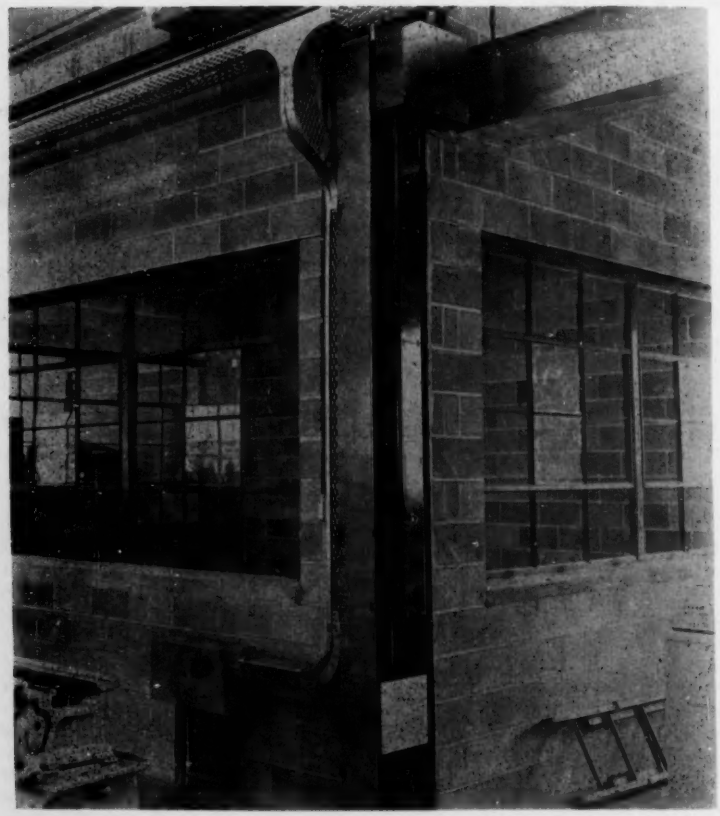
In conducting these classes, I draw diagrams on a blackboard, discuss problems, and assign homework that we go over in class. We may take a job the apprentices worked on that was rejected because of a Code violation and review why the job was rejected and what must be done to bring it up to certain standards. We have several sessions in blueprint reading and the interpretation of specifications in order that enough architectural and constructional drawing is understood by the apprentice so that he knows what a building looks like and what the conditions will be on the job.

We encourage apprentices to talk and inquire about what they do not understand, and we impress on journeymen how important it is to be patient, tolerant, and willing to learn themselves, for with years of experience we all tend to forget why a routine procedure is used and do not stop to question whether there may not be a better way of doing it.

Simultaneously with these classes, on-the-job training is planned to make all-round mechanics of apprentices. During their four-year apprenticeship men may be found wiring for air conditioning, ranges, and major appliances in residential electrical maintenance; heavying-up the

(Continued on page 97)

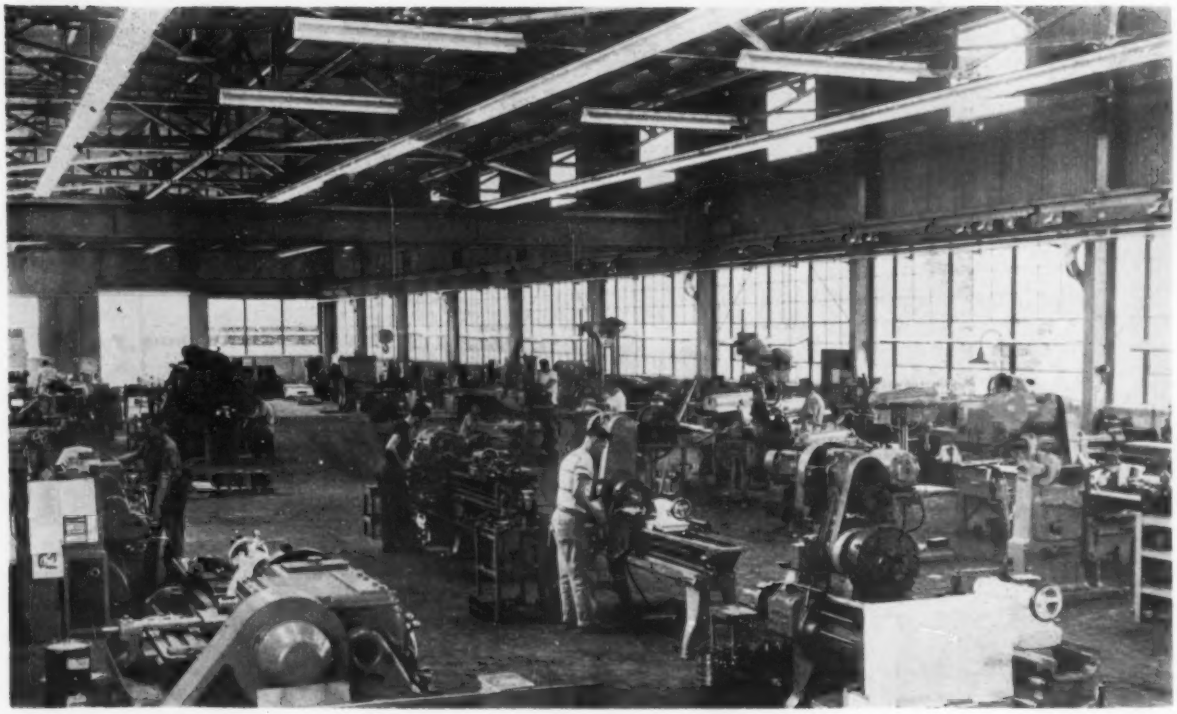
Grouting was placed at each raceway joint and junction box prior to pouring floor slabs.



440 volt, three phase power is distributed from plug-in busway via expanded metal cable trough and underfloor raceway to machinery.

How to

All junction boxes and raceways were anchored with reinforcing rods rather than standard raceway supports because of the dirt base.

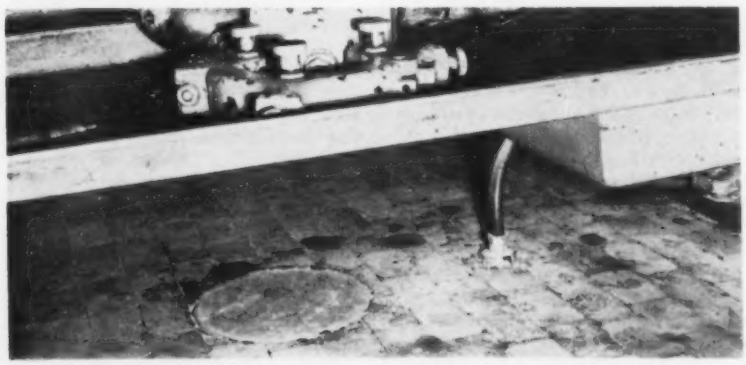


Complete freedom overhead and around all machinery is achieved with the underfloor raceway system.

wire a machine shop

This article should be especially helpful to the following readers:
- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers ✓
- Consulting Engineers ✓

◆ THREE METHODS of electrical distribution—underfloor duct, cable trough, and busway—have been effectively combined to meet the requirements of a combination machine and electric shop. The result is maximum electrical availability, flexibility of layout, and ample overhead clearance for crane operation.



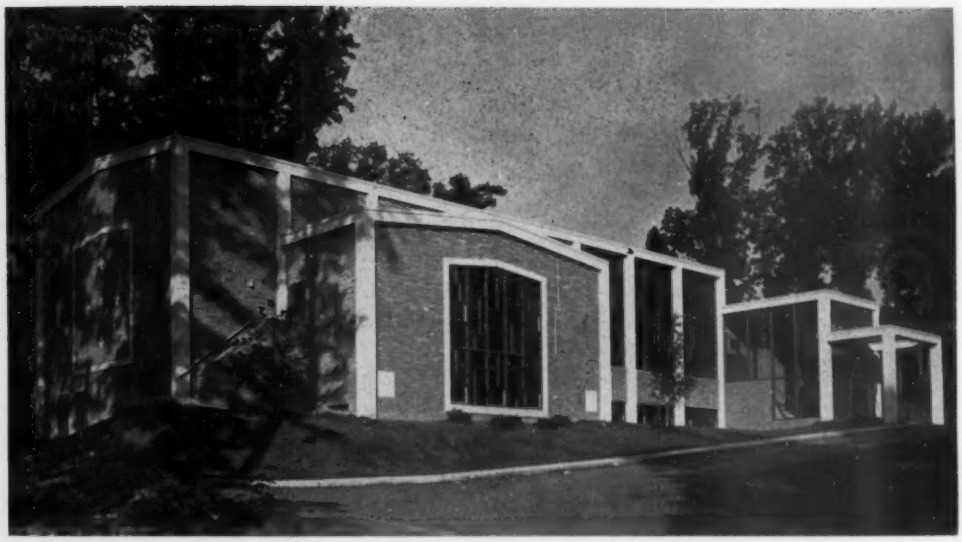
Nearest underfloor duct insert brings wiring from raceway to machine.

Imbedded in an 8-inch thick concrete floor is a Walker power raceway system, comprised of four longitudinal runs, five lateral runs. The Walker Powerduct has 2-inch IPS diameter, preset inserts located on 24-inch centers and was selected as a means of electrical distribution because the system facilitates electrical hook-up of new or re-located machinery; also it affords overhead clearance which is necessary to permit crane operation the full length of the building.

The underfloor distribution system—which includes 2-inch Walker Dualcote rigid steel conduit used as auxiliary wiring capacity—is stubbed up the walls approximately two feet. Here, both duct and conduit terminate in a wall-mounted junction box.

From these boxes, cables extend upward through Cope expanded metal cable trough to Bulldog, 225-ampere copper plug-in busway. The busway is installed in

(Continued on page 98)



Pilgrim Lutheran Church is weather-conditioned for a variable climate.

Washington churches install heat pumps

By Milton J. Prassas

Milton J. Prassas & Associates
Architects and Engineers
Washington, D. C.

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

◆ THE USE of heat pumps in Washington, D. C., increased very rapidly in 1957 but only one church made use of it during this period, Pilgrim Lutheran Church, West Bethesda, Md., a suburb of the nation's capital.

However, as the results here developed, we understand that four designs for new churches will use heat pumps. Three of these have been designed by our office, and are now under construction, Holy Comforter Evangelical Lutheran Church, Good Shepherd Evangelical Lutheran Church, and St. John's Evangelical Lutheran.

It should be interesting to review the story of why the first church, Pilgrim, was designed to use heat pumps. The congregation wanted their new edifice to be a contemporary building with every modern convenience and air conditioning to cope with the hot, sticky weather of Washington.

They specified that original construction costs should be as low as possible, and that as much useable space be available for church operations as could be spared. The appearance of their building was to be outstanding, yet esthetically graceful on both the outside as well as the interior.

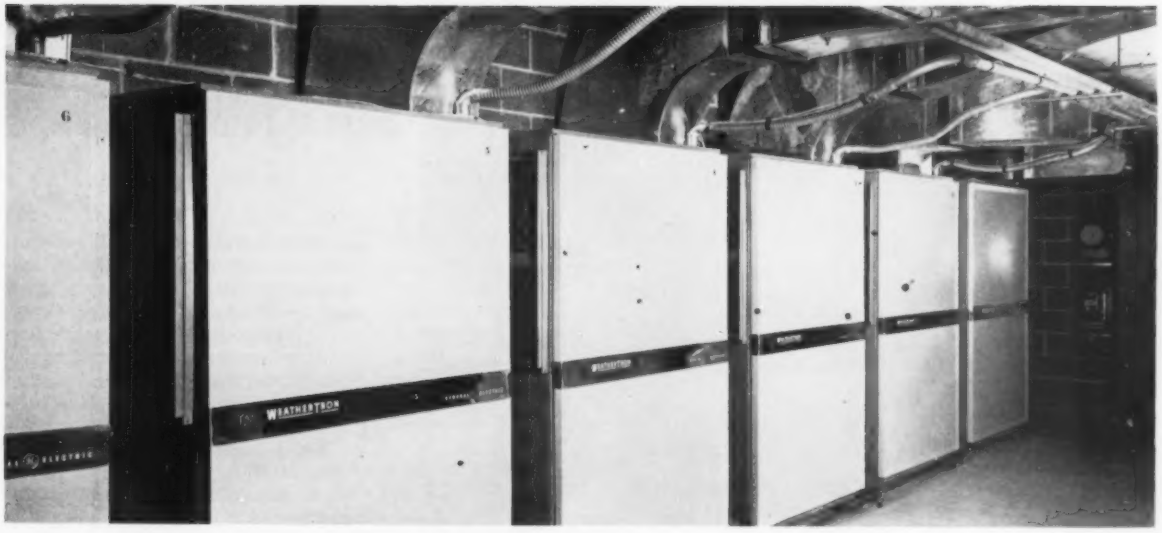
As all architects know, programing for a church project involves the present and future. This means long range planning for a building or groups of buildings, capacity of equipment, and central location for most economical distribution of the heating and cooling mediums.

When the long range program is an indefinite item within the church's council, then it is certainly indefinite for architects. Planners must figure on an oversize capacity, since they do not wish to be short when it is too late and too costly to make changes.

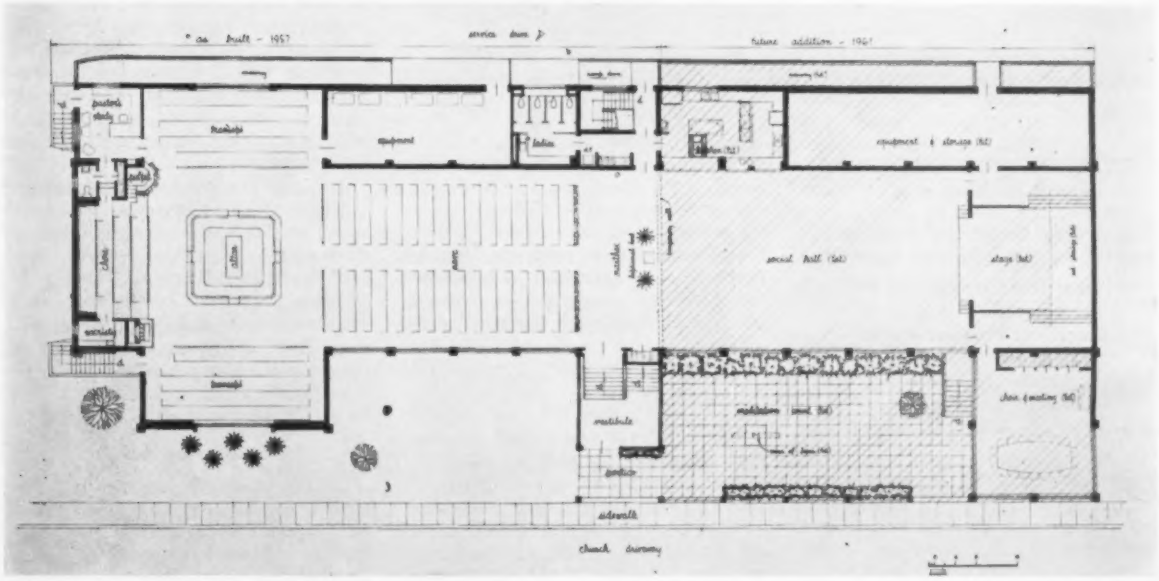
When the conventional heating system using fuel fired equipment is planned for a building or buildings, the equipment or boiler room and the chimney must be located for efficiency and future building extension, and it seems that the plans for building design must evolve around this equipment. This restricts the architect's creative potential particularly in the field of contemporary simplification. It also increases the capital investment because in such cases, the equipment must be oversize for the present requirements.

In the opinion of the author, this very fact of planning for a central heating system to accommodate present and future, plus the necessary building to house such a system, costs the church money they can ill afford to spare. In the case of Pilgrim, a boiler room and chimney was estimated to exceed $5000.00. By using the heat pumps, which could be located and utilized any place it was best suited, meant a savings in capital investment, and gave a better chance to design a building to fit the church's needs for the present.

Since all of the equipment did not have to be in one place, the use



Heat pump installation provides for future expansion.



Plan view of sanctuary level. The heat pump installation is in the room marked "equipment." Shaded area at right shows future additions. A multi-use level below the sanctuary level has its own heat pumps.

of zones with their own controls was possible, which we thought to be practical for this application. The weather in Washington dictates that public buildings must have equipment for both cooling and heating, in order to do the best job for the owners.

The control must be such as to provide either heating or cooling on minimum notice because of Washington's variable weather. In this instance, because of the "people loads," there are times when one room is on cooling while the other is on heating.

By using equipment which is entirely automatic, for a church, it means that no special effort is needed from a janitor or other assigned personnel to be on hand ahead of time, or all the time, to insure a comfortable environment. If automatic controls are valuable, it would be in a church for automatic cooling and heating to fit the weather needs.

Boiler rooms and fuel fired equipment in a public place where attention may be lax can present a fire hazard. This is easily avoided where heat pumps are used. What were the salient design features at Pilgrim which made this heat pump installation acceptable to the church council, and superior to any other system?

The first increment, the constructed building, consisted of a sanctuary for worship of 3000 square feet with seating capacity of 441, and a ground level multi-use area of 3000 square feet directly below it. This includes kitchen and Sunday School. The necessary heat pump units for the sanctuary and the multi-use area were grouped in two separate places and close to the areas cooled and heated. With this arrangement,

(Continued on page 99)

Medallion

This is a typical Medallion home in Brownson Terrace subdivision, where every home built thus far has qualified for the Medallion seal.

By Ruel McDaniel

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ EARLY this year R. D. Smith, district manager, and Philip O. Gilbert, district commercial manager of Central Power & Light Company, in the Victoria, Texas, district office, called a meeting at the company's auditorium. This meeting included nearly every builder in the Victoria district, most home-building architects, contractors, electrical dealer-contractors, and even some home loan officials.

The purpose of the meeting was to "kick off" the district office's drive for the construction of Medallion Homes in the area.

Speakers told the guests the meaning—to them and to home owners—of better electrical living and explained what electrical appliances and outlets constituted a Medallion home. CP&L men distributed brochures supplied by the national organization and mimeographed material prepared locally to give a local touch to the promotion.

According to Mr. Gilbert, as a consequence of this early "grass-roots" program to upgrade Housepower in the area and to promote more Medallion homes, the district office soon exceeded its timetable materially and produced some results totally unexpected from the campaign.

It was expected that some area home builders would fall in line and help to promote better electrical living, and most of them did. One realtor opened a 40-acre sub-division and announced that he would encourage all builders who bought lots there to specialize in the construction of Medallion homes. Although it is not a specific requirement, all homes thus far built there have been Medallion homes.

Effect on home remodeling

It was not expected that the program would upgrade electrical modernization in home remodeling and repairs as quickly as it has. Mr. Gilbert declares that of all home building and remodeling since January, more than 90 per cent of it is of a higher standard electrically than for the period just prior to the opening of the drive.

"In other words, the promotion and publicity regarding Medallion homes and better living electrically have influenced the general public to demand better electrical facilities in their new homes and their remodeled kitchens and added rooms," Mr. Gilbert said. "The program has stepped up Housepower in all home construction, not just in the Medallion homes, and that is something that we had not expected to accomplish so soon."

Brownson Terrace subdivision, being developed by J. E. McCord, Victoria realtor, contains 125 lots. It is Mr. McCord's hope that every lot will be occupied by a Medallion home. Thus far, nearly one-third of the lots have homes finished on them or homes in process of construction. All are Medallion homes, and one has the coveted Gold Medallion seal imbedded in its threshold.

In order to keep the promotion rolling, Central Power & Light men at Victoria worked out a systematic follow-up program after that initial meeting of contractors, builders, architects, and others concerned with home building. This follow-up program has continued to expand and enlarge the public and professional interest in better electrical living.

Promotion kits

As an example of local promotion, the company makes up "kits" of material supplied by the national association on Medallion homes and Live Better -- Electrically, supplements this with material of its own, showing in detail what is required, electrically, for the new home to qualify as a Bronze or Gold Medallion structure. One of these kits goes to every person who buys a lot in the Brownson Terrace subdivision and to lot-buyers in certain other better-class housing projects. The kit also contains building plans adapted to local needs and trends. It is aimed at aiding the prospective home-builder not only in the selection and designation of his electrical appliances and wiring but also in planning his new home generally. The same kits are available to building contractors who want them for their prospective customers.

Home program goes over big in Texas

Mr. Gilbert and R. J. Anderson, district new business representative, work constantly with home-building contractors, to help them plan and lay out new homes for the proper use of electrical appliances and installation of outlets that will qualify the homes for the Medallion emblem.

Naturally this sales effort is not confined to the single sub-division which is specializing in Medallion homes, but it extends to all areas of the district where builders are willing to cooperate with the company toward better-wired and electrically equipped homes.

Mr. Anderson spends the greater part of his time contacting home-building contractors and architects in an effort to persuade them to include the proper appliances and wiring to qualify the homes they are planning and building for Medallion status. He assists in every possible way by making suggestions.

He reads the papers, checks public records, and keeps his eyes open as he drives around the city for foundations of new homes. When he sees that a new home is to be built in an area of better-type construction, particularly, he immediately contacts the building contractor, if he has not already been working with him, and tries to persuade him to upgrade the electrical facilities to qualify the home for a Medallion emblem.

If the contractor balks for the reason that he cannot add anything additional to the cost of the home, Mr. Anderson then goes to see the owner of the new home and persuades him that he will like his new home better if he will instruct the contractor to spend a little more and make the structure completely modern electrically.

Contacting home owners

This individual work among home owners has done much to upgrade electrical facilities in new homes. Even though some do not qualify as Medallion and even though the visit with the new home owner does not influence him to change his plans at the moment, it sells him further on electrical modernization; and he is then a prospect for more outlets and appliances later.

"The building contractor doesn't object to our going directly to the home owner," Mr. Anderson points out, "for if we can persuade his customer to spend more money for electrical upgrading, it means something additional to the contract."

By July 1, two Gold Medallion homes had been built in Victoria. CP&L men worked step-by-step with the contractors and architects to help in planning and laying out the two homes so that they could qualify for the gold emblem.

"We believe that whatever time we have spent in helping to complete these initial homes will be well rewarded in the future, because the significance of Medallion homes already has caught on, and the public, as well as the contractors, is keenly conscious of the importance of upgrading the home electrically," Mr. Gilbert emphasizes.

Contractor Herbert W. Post is proud of the switch box in his Gold Medallion home in Brownson Terrace.

Contractor Post checks the electric unit to open and close the garage doors in a Medallion home.

Apartments wired for the future

By Margot Mejia

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

◆ THE THEME of adequate wiring has been played endlessly in electrical advertising, residential building programs, and home improvement promotions. Seldom, however, can an electrical installation be truthfully described as "wired for the future." For example, in how many new, 1-bedroom apartments does a tenant find 45 outlets for his use? Even if he owned nearly every appliance on the market, he would have outlets to spare!

But today's electrical requirements, borne out by nationally-compiled utility company figures, show kilowatt-hour consumption to be on an amazing and steady climb. The national average for 1957 was 3,174 kilowatt-hours per residential consumer. Based on previous increases, key men in the electrical industry predict a figure of over 8,500 hours by 1975—or possibly tripled consumption! Going along with this prediction, the home or apartment building which is wired in compliance with today's minimum standards may well be electrically obsolete in the coming decade.

Ample number outlets

Future planning has made Houston's 1400 Hermann Drive apartment building unique in many ways, but it is particularly unique in the eyes of local electrical contractors. In order to protect his large investment, the builder determined that passing years would not necessitate several remodeling programs in order to keep pace with the increasing electrical needs of the building's tenants. No matter what tomorrow's appliances may be or how many, the tenants of 1400 Hermann Drive will have ample power and a selection of outlets to use them.

Behind the building's luxurious exterior and interior is its "futuristic" wiring. Bus-duct risers—1,350 ampere, 3-phase, 4-wire—run through the structure with feeders on each floor leading to the individual apartments. Large 5- and 6-room apartments have three #4 feeders; smaller apart-

1400 Hermann Drive, where careful electrical planning will provide for the electrical needs of the next 20 years, without remodeling.

Typical of this modern apartment building's electrical adequacy is this double row of lights in the garage to guide patrons to parking places and allow for close supervision of the large area.

Modernize Electrical Distribution

For more economical operation
increase feeder capacity and efficiency
by transmitting at a higher voltage

To step down the higher distribution voltage to utilization voltage in institutional, commercial and industrial buildings it is important that high efficiency transformers are installed at load centers. SORGEL dry-type transformers are the most practical for this purpose. They require little or no maintenance; no liquid to check or replenish; no vault required; small and compact; easy and economical to install. Sorgel dry-type transformers provide the highest efficiency, which reduces operating costs.

Easy and Low Cost Installation

All self-contained in a single unit — either single phase or 3-phase — with simple connections to make. No separate mounting brackets or junction boxes to make or buy. Substantial wall brackets, with slots for bolts, or floor mounting base, are an integral part of Sorgel transformers. Roomy connection compartment with wide choice of knock-outs. Solderless terminals.

Quietest Operation

SORGEL sound-rated dry-type transformers are so quiet in operation that there is no disturbing hum. They are particularly adaptable for installation in hospitals, schools, office buildings, stores, and buildings where sound level is an important factor — as well as industrial applications. Therefore, they can be installed in almost any convenient place, inside of buildings, close to the load center. This results in shorter feeders, better voltage regulation, more efficient distribution, and lower wiring cost.

High Efficiency and Full Capacity

SORGEL transformers are guaranteed to carry the full rated load continuously at high efficiency. They are so liberally designed that they can carry an overload during an emergency at a safe operating temperature.

Complete Line for Every Purpose

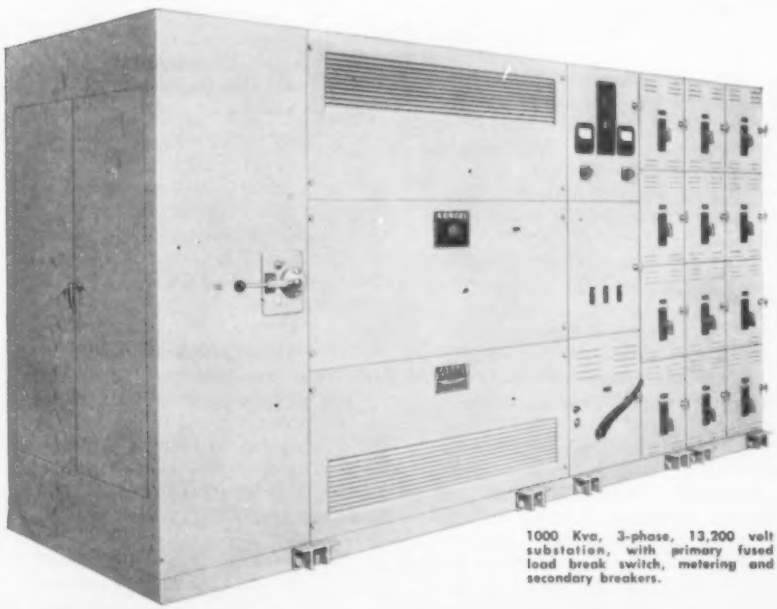
These transformers are available in a large variety of sizes and types for every purpose. ¼ Kva to 3333 Kva single phase. 1 Kva to 10,000 Kva 3-phase. All standard voltages, such as 120, 208, 240, 277, 480, 600, 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts.

50 Kva 3-phase, 480 to 208Y/120 volts. Wall mounting transformer. Connection compartment panel removed.

A Perfect Partner for Substations

Sorgel transformers can also be incorporated in substations, complete with primary and secondary switchgear. They are procurable with any type or make of switchgear, and from any substation manufacturer.

Sales engineers in principal cities.
Consult the classified section of your telephone directory or communicate with our factory.



1000 Kva, 3-phase, 13,200 volt substation, with primary fused load break switch, metering and secondary breakers.

SORGEL ELECTRIC CO., 835 West National Avenue, Milwaukee 4, Wisconsin

Over 40 years' experience in the development, manufacturing and application of transformers

ments carry three #6 feeders. Each unit has a 10-circuit lighting panel in the kitchen or in the air conditioning closet. All rooms except kitchens and baths have 2-circuit wall receptacles with independent switches.

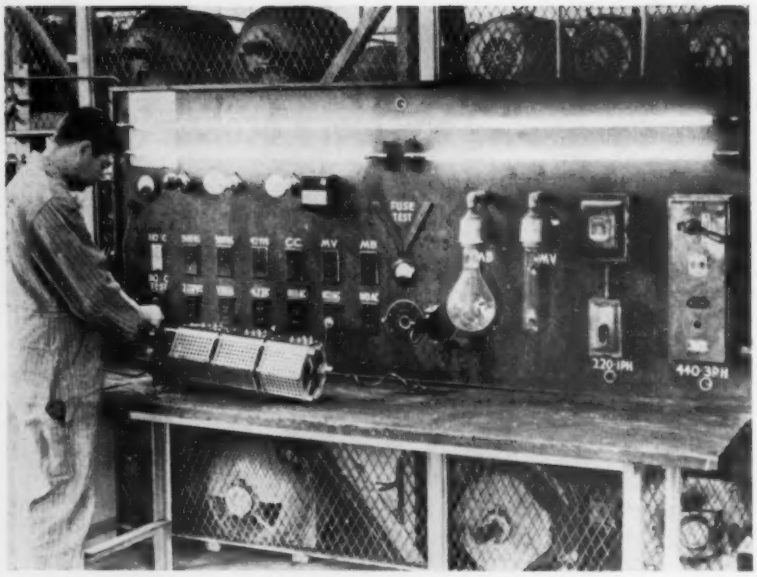
All appliances are electrical—wall ovens, ranges, dishwashers, and refrigerators. For perfect television reception, all a tenant needs to do is plug in the set—a rooftop antenna provides a direct hook-up to all living rooms and most of the bedrooms. Air conditioning units are installed in closets with master wall switches to control the filtered, pollen-free air. An intercommunication telephone connects with the doorman, the garage, and other service departments. An average of 45-50 outlets are present in each apartment.

Fischback & Moore, electrical contractors for the 1400 Hermann Drive installation, refer to this job as being "far more than adequate" in terms of wiring. James Watson, engineer for the project, says that he knows of only one other apartment building in Houston which comes even close to this "futuristic" wiring.

Importance of lighting

The builder's views regarding the importance of lighting can even be seen from the street approach. A porte-cochere over the entrance glows with 2,000 square feet of luminous paneling. Just inside the lobby hangs a brilliant chandelier, originally designed for candles but now wired for electricity by the decorator. A 3-level garage is illuminated with a double row of fluorescent fixtures in the lobby level; the same fixtures being spotted throughout the other floors. Electric washers and dryers provide laundry facilities for the tenants in the service area.

In an apartment building where rents range upward from $175 monthly, it is not surprising to find the ultimate in luxurious surroundings. Equally important—although not as evident—is the electrical installation, prepared for the needs of the next 20 years or more. In a city where the kilowatt-hour consumption runs about a thousand hours more than the national average, a wave of wiring-modernization can be expected. But through the foresight of its builder and his ahead-of-the-times electrical installation, tenants in this building can serenely watch the invention and marketing of dozens of new appliances.



Testboard at Calumet and Hecla Plant, Decatur, Ala.

Testboard speeds maintenance work

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers ✔
- Consulting Engineers

◆ "IF A PART seems to be giving trouble, don't check it — yank it. . ." that is the operating policy of the Electrical Department at Calumet & Hecla's Wolverine Tube Division plant in Decatur, Alabama.

Rather than shut down an operation for an on-the-spot repair of a fuse or even a motor, the department's procedure calls for immediate replacement from spare-part stock. The troublesome part is returned to a centralized electrical maintenance shop for required work.

A three-fold advantage has been found in this procedure; equipment downtime is kept to a minimum; maintenance work can be scheduled without pressure from the production department because of idled equipment; and it's more economical to do electrical repair work in the shop.

To facilitate the centralized electrical maintenance and repair work, Calumet & Hecla engineers at Decatur devised a highly versatile testing arrangement. Consisting of a simple work surface and panel board, on a simple channel iron frame, the set-up permits easy and convenient trouble-shooting and repair of malfunctioning equipment.

The testboard provides the following facilities:

Outlets for testing regular and mogul base incandescent lamps, mercury vapor lamps and cold cathode fluorescent tubes in two lengths;

V-notch fuse tester;

Small circuit continuity checker with a multiple switch to add resistance for current limit;

"Powerstat" variable transformer providing 0-250 volts a-c single phase;

110 a-c and d-c; 42 d-c; 220 a-c single-phase 220-440 three-phase a-c;

Size 1 to 50-hp starters;

Variable push button for 42-volt

(Continued on page 95)

New circuits in seconds at half the cost!

COORDINATED COMPONENTS. BullDog equipment works together to feed specific industrial, commercial or institutional power needs. Whether it be LO-X®, Plug-In Duct, a substation or a complete distribution system, BullDog can help you put a business in top electrical shape and keep it there! © BEPCO

As power goes, so goes production. Recently, an automotive parts plant smoothed major kinks in *both* with an installation of BullDog Plug-In BUStribution® Duct. Where powering new machines and constant shifting of existing equipment once meant electrical downtime and delay, machines now plug into power in seconds. No rewiring, downtime or costly production halts. And the electrical cost of moving and adding machinery has been slimmed by 47%.

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Leg-saving service for busy contractors

By Harry J. Miller

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities
- Electrical Wholesalers ✔
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers ✔

◆ AS OFFICIAL representative for the Florida West Coast Electrical Contractors' Association and the West Coast Chapter of NECA, A. I. Brannon feels the association has evolved a workable plan to save contractors' time, money and spirits.

"It costs a contractor money to go out and look at a job, look up a job or make a bid on it," says Brannon, "and then perhaps not stand the ghost of a chance to land it.

"When a customer thumbs through the yellow pages of the phone book and calls a particular contractor, that contractor may be deceived into thinking he's been preferred above other contractors, so he hastens to compile an estimate.

"However, under our plan, whenever a job exceeds $200, the contractor-member phones in to us to register the job and its location.

"It's very likely that the customer will contact a number of contractors in order to obtain comparable bids. But each time an association member receives an invitation to bid, he phones it in for our registry.

"Thus by the end of the day, seven or eight contractors may have called in to register the same job. Since we call back each contractor who phoned the job in, they soon know just how many of their competitors have been tackled for the job, and they're alerted to the fact that this is a bid-shopping customer.

How the plan works

"Let's assume one of the contractors is pretty busy. By the time we call him back four or five times, as each contractor phones the job in, he may decide not to go after it at all, and say: "Scratch me off," since he isn't inclined to waste time going out to bid a job that shows the earmarks of being beaten to death.

"In this manner our action saves repetitive bidding and this acts like a clearing house for information."

Again it may happen that a contractor discovers he has a competitor for the job who has such a reputation for efficient operation or for cut-corner estimating that he makes too formidable an opponent, in which case the first contractor, realizing his own inadequacies in this direction, may drop out of the running entirely.

"No figures are mentioned in our phone-registry service," says Brannon, who has the association members so classified he is keenly aware of their capabilities. He knows who has the set-up for the smaller jobs and who is capable of swinging the bigger contracts. He gets the specs for the members, takes them off, and where a contractor may be bidding a job too big for him to handle, Brannon won't hesitate to tell him the facts of business life.

"To supplement our system of job registry, we supply the needed legal information like the plat lot and property card. This means that when a successful contractor applies for a permit, he has the required information and needn't cool his heels in a City Hall corridor while officials hunt it up," said Brannon.

Subterfuge practiced

"We have no local ordinance here barring a newcomer or beginning would-be contractor from cashing in through exploiting the holder of an old Master's Certificate by the mere process of renting it. In that way, these fellows can get in-

A. I. Brannen

to the contracting business even though they're unable to pass the exams. Holders of these old certificates find them highly lucrative, since their rental value runs in the neighborhood of $50 a week.

"Some of these certificates were validated prior to the inauguration of Master's examinations, coming in under the grandfather's clause. Chances are that a percentage of such certificate holders couldn't pass a helper's examination today," said Brannon.

Nevertheless this practice helps muddy the waters of legitimate competition, even though today's journeyman in this area must sit for a Master's exam as a prerequisite for entering the contracting business.

Low overhead delusion

Brannon's feeling is that probably one of the greatest fallacies in the reasoning of the average small contractor is the delusion that he can "beat the bigger contractor on this job because I have a lower overhead." It is this favorite misconception that induces such a man to bid a job which is over his head financially or for which his operational set-up is woefully inadequate.

Says Brannon: "Chances are their proportion of overhead per dollar volume is a whole lot more than the overhead costs of the bigger contractor.

"For example, a couple of buddies go into the wiring business. If they'd consider the nature of their varied expenses like telephone, office, truck, etc., for the amount of work two men can

(Continued on page 100)

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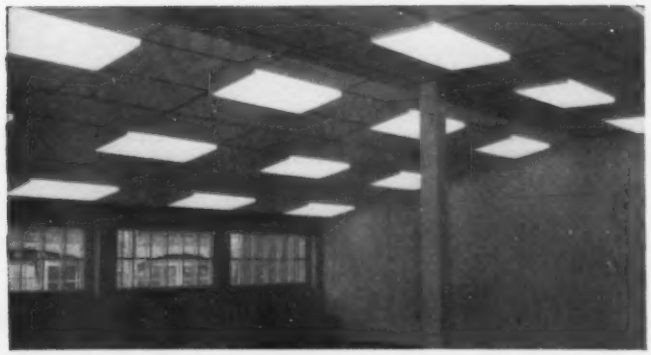

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Public Utilities of Virginias hold annual meeting

This article should be especially helpful to the following readers:

Electrical Contractors
Electric Utilities ✓
Electrical Wholesalers
Electrical Inspectors
Industrial Engineers
Consulting Engineers

◆ THE LEADERSHIP ROLE of public utility companies in community and area development programs received major attention at the 40th Annual Meeting of the Public Utilities Association of the Virginias at White Sulphur Springs, W. Va., last week.

The Governor of West Virginia, the head of a large electric utility system, and the chairman of the Association's own Area Development Committee discussed a number of aspects of utility participation in the race for new industries now under way in all parts of the nation.

Governor Cecil H. Underwood, of West Virginia, lauded the utility companies of his state for their interest in community development work extending over the past 20 years. He said industrial expansion in West Virginia recently has been encouraging, but much more growth is needed particularly in small communities. He announced that his administration will support a proposed legislative measure creating a state-wide industrial development credit authority to supplement local new-industry financing programs.

Area development

At the same session of the meeting, Earle S. Thompson, chairman of the board of the West Penn Electric Company, New York, described the philosophy of his company and neighboring electric companies in initiating industrial development as a regular company activity several years ago. He said area development in the utility industry originated with the idea that a new industry "offered itself as a direct buyer of our wares." The employees of a new industry also were either new customers or potentially larger customers. When the electric and gas companies comprehended the full potential of area development, tney soon realized that an effective community development program is public relations at its best. Thompson noted that every electric utility company and a number of the gas utilities in Virginia and West Virginia have staff personnel devoting their full time to this type of work in cooperation with local and state civic and governmental agencies.

George W. Buzzerd, director of industrial development, Monongahela Power Co., Fairmont, W. Va., and chairman of the Association's area development committee reported on a long range study of the benefits of a new industry to a community and to the utilities serving that community. Case his-

(Continued on page 99)

Electric utility officers seen in a between-sessions conference are (left to right) G. L. Furr, vice president and general manager, Appalachian Power Co., Roanoke, Va.; Don B. Potter, president, Monongahela Power Co., Fairmont, W. Va.; and Earle S. Thompson, chairman of the board, West Penn Electric Co., New York.

PUVA President John C. Parrott (left) with Earle S. Thompson, chairman of the board, West Penn Electric Co., New York, and John W. Landis, assistant manager, Atomic Energy Division, Babcock and Wilcox Co., Lynchburg, Va.

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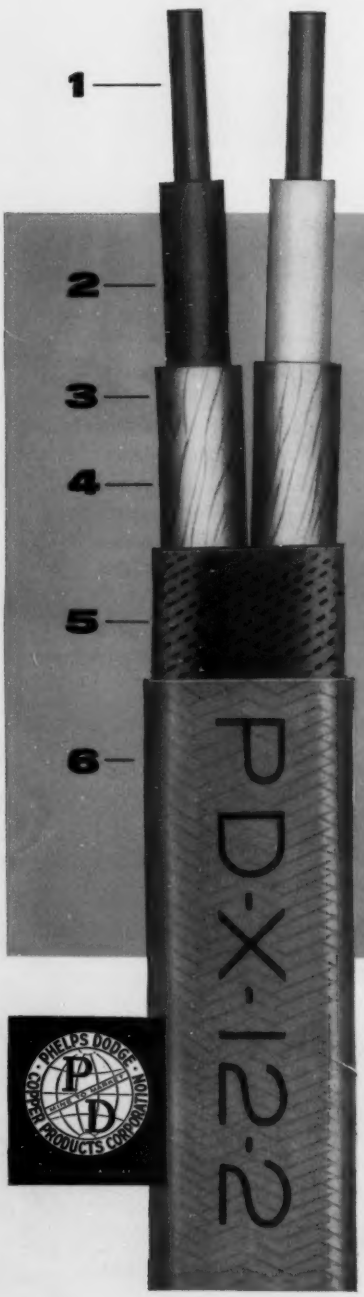

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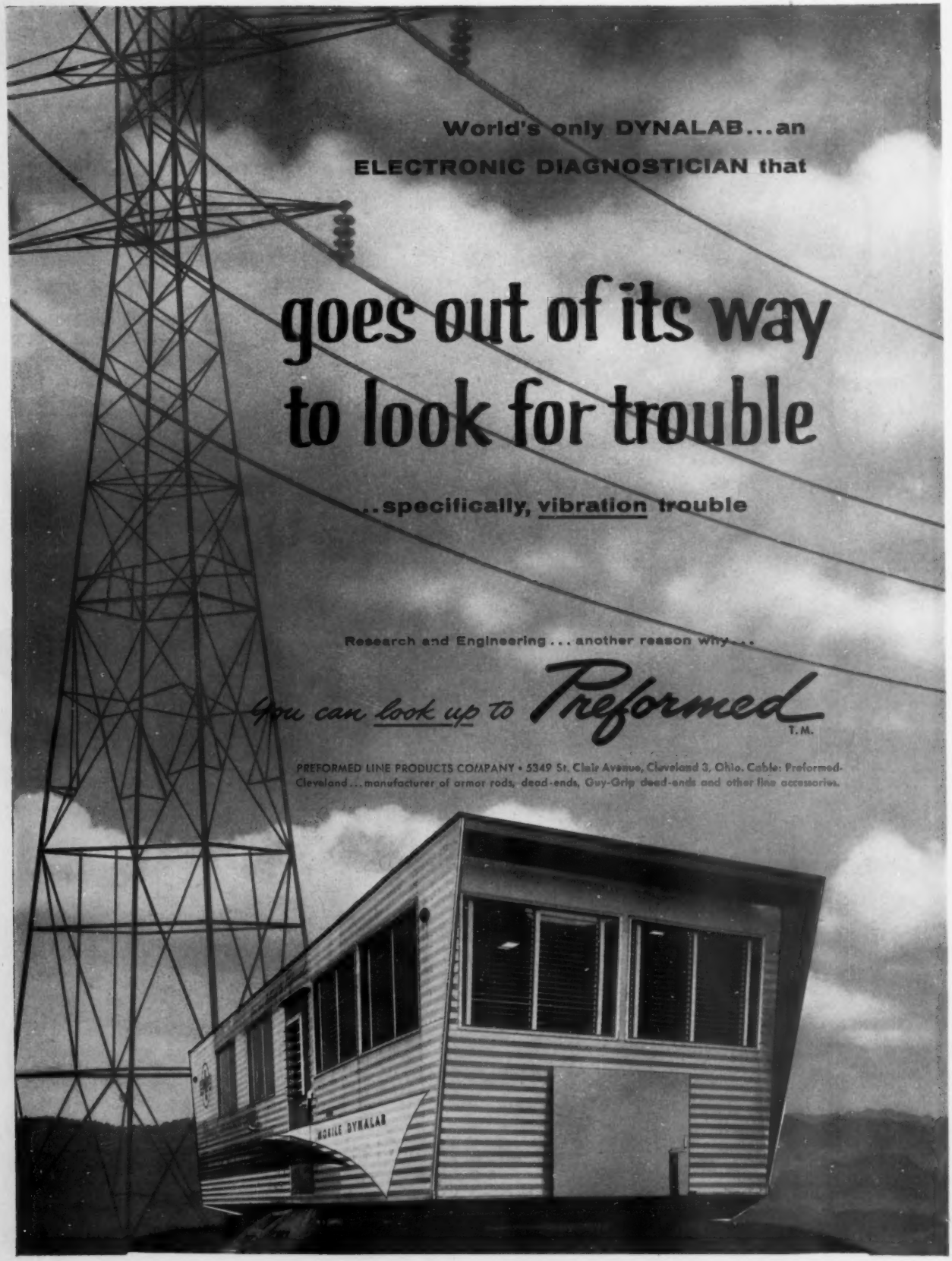
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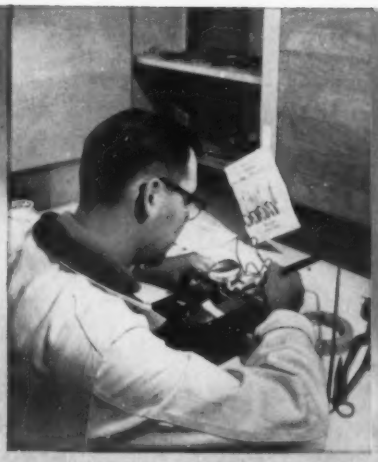

No. 3 of a series...

Vibration of overhead lines still represents a major problem to the utility industry. Although significant improvements in hardware design and construction practices have been brought about through expanded research efforts, the incipient hazard of conductor failures due to fatigue and abrasive wear is becoming an increasingly important problem as the size and cost of transmission line construction continue to increase.

Laboratory vibration research has steadily progressed and has recently been accelerated by the expansion of vibration test facilities and refinement of instrumentation and testing techniques. Field measurement techniques, however, have not kept pace with laboratory advances. Therefore, relatively little quantitative data is available from field investigations for extension of laboratory studies. A few outdoor test spans and isolated field measurements have provided only sparse and often inconsistent results due largely to lack of coordination of these projects and inadequate instrumentation techniques.

The mobile vibration laboratory (Dynalab) recently completed by Preformed Research and Engineering was created by a select team of vibration engineers and electronics specialists to fulfill this need in the practical solution of line vibration problems. Operational requirements were painstakingly studied in cooperation with leading utility engineers. Radical design departures were necessary to overcome the unique problems of instrumenting and monitoring energized EHV transmission lines. A special trailer was designed to provide the high degree of mobility required to obtain data from a variety of geographical regions and remote locations throughout the country.

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Jon R. Ruhlman, Vice President
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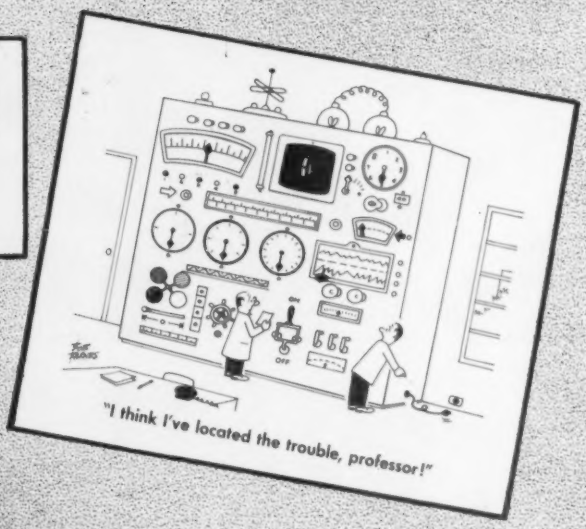

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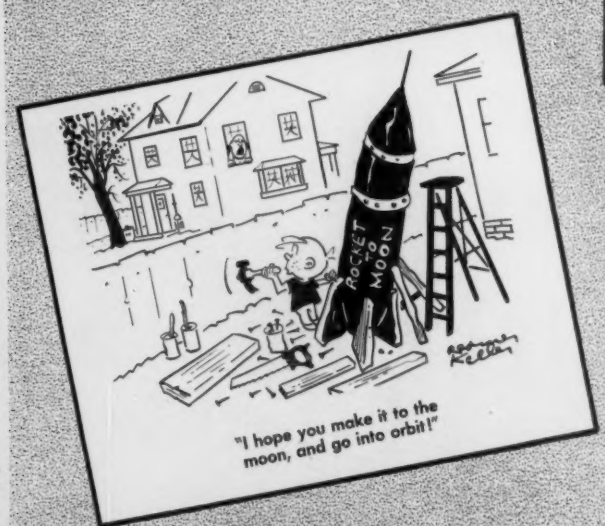

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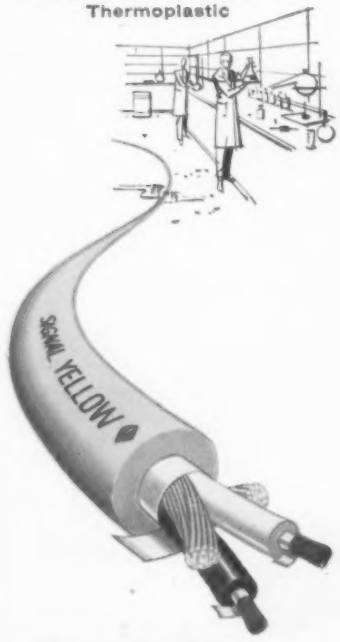

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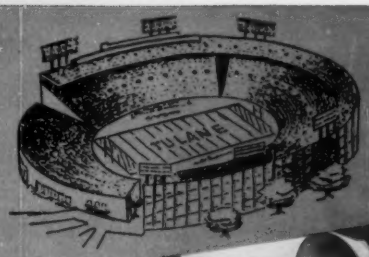

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Workman at Sugar Bowl checking INTENSO light before bank is raised to lower height.

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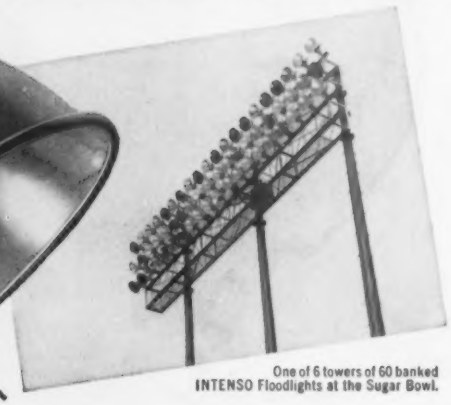

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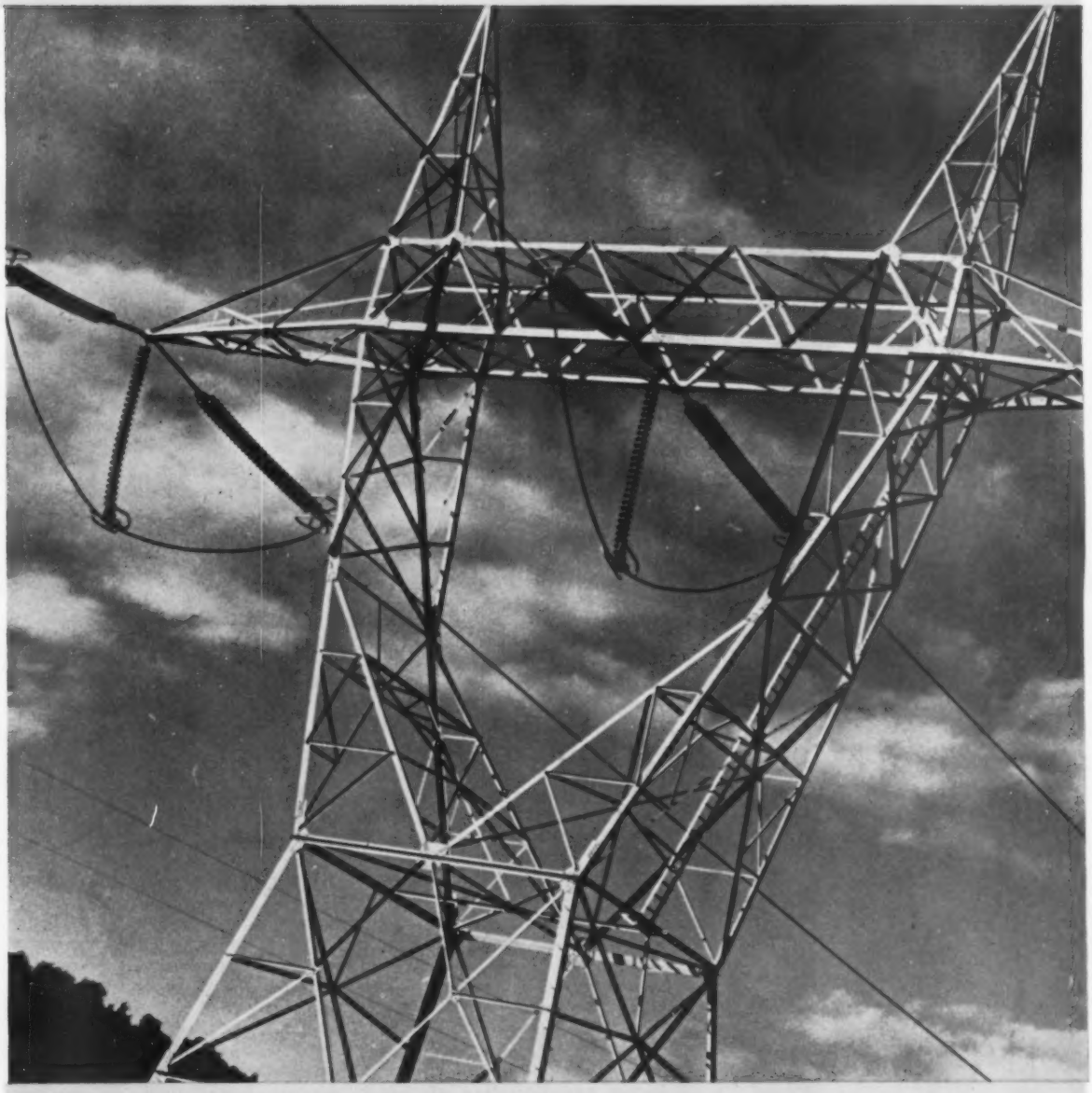


Applying load break and ground switches effectively—page 46
Meter by-pass reduces interruptions—page 52

Load break and grounding switches

By C. E. Upton*

Westinghouse Electric Corp.
East Pittsburgh, Pa.

◆ IN THE OPERATION of an electric utility system, there has existed for many years a need for equipment to fill the void that was present between power circuit breakers with fault interrupting ratings and the air break switch, which has no interrupting rating and which has a very limited interrupting ability. Air break switches are designed simply to isolate other equipment for maintenance purposes or to sectionalize power systems, and generally speaking, these switching operations are performed with the system de-energized.

While the switches have no guaranteed interrupting rating, they are frequently called upon to interrupt on arcing horns, small amounts of line charging current, transformer magnetizing current, or even light paralleled load currents. This operation of air break switches to interrupt these small amounts of current can be fairly successful if weather conditions are favorable and if the operator has made certain that the current to be interrupted is small. This sort of operation is accomplished regularly, although admittedly it is a gamble. An interesting summary of the experiences of fifty-nine utilities in interrupting small currents on arcing horns shows that the actual per cent of successful operations ranges from 50 per cent to 100 per cent, depending on magnitudes of voltage and current which are involved as well as the uncontrollable weather factor.

It is evident, then, that under the most favorable conditions this type of operation for an air break switch is not an assured success. A hazard to equipment, personnel, and continuity of service definitely exists where there is uncontrolled arcing. The inherent nature of unconfined arcs to wander in long circuitous paths and travel with the slightest wind provides no assurance that the arcing associated with opening an air break switch will not bridge phase to phase or involve grounded structural members.

From the standpoint of economics the electric utility company cannot justify the cost of a power circuit breaker with fault interrupting ability simply to handle the infrequent switching of load or charging and magnetizing current. The need for a low cost load switching device is quite apparent.

Load break switches

Westinghouse pioneered the high-voltage load interrupter field at transmission voltages with the introduction of the VLB switch in 1953. This switch is a modern high-pressure wiping contact, three insulator, vertical break pole unit with a gas filled interrupter and auxiliary current path electrically in parallel with the main switch current carrying members. The interrupter mounts on the jaw insulator stack and is coordinated with the travel of the main switch blade as it travels to the open and closed positions. The auxiliary blade or paralleling electrical member coordinates with a pick-up arm on the main switch blade to isolate the interrupter after it has cleared the circuit.

The interrupter itself is a sealed porcelain-clad assembly filled with sulphur-hexafluoride gas. This gas has exceptional ability as an arc extinguishing medium and by applying it in an axial flow device an interrupting ability of 600 amperes, 50 per cent power factor from 15 kv through 138 kv, can be provided. These interrupters also handle transformer magnetizing current, line charging current, and the switching of single capacitor banks. They are capable of 500 operations at full load with many more operations possible at lower magnitudes of current.

A better understanding of this load interrupter can be had from a brief description of its principal of operation. The complete load break pole unit for 115 kv service is shown in Figures 1, 2, and 3. The switch is closed (Fig. 1), and in this position the main switch contacts are closed as are the contacts within the interrupter. The normal current path is through the main switch blade with only a negligible amount of current passing through the paralleling interrupter and auxiliary blade. The center insulator column is rotated to open the switch and interrupter in the following sequence:

(1) The first 30 angular degrees of rotation of the driving insulator causes the blade to rotate about its axis to give a contact-wiping and powerful ice breaking action while releasing the pressure of the stationary contact jaws, (Fig. 1).

(2) The second 30 degrees of insulator rotation causes the blade to rise from the stationary contact thus diverting the current through the interrupter unit and the interrupter isolating blade, (Fig. 2).

(3) After the insulator has been rotated a total of 60 degrees, the main switch blade engages an arm on the interrupter housing which trips an over-center toggle mechanism to cause contacts to part at high speed within the interrupter. Thereby the flow of current is without any external display.

(4) After tripping the interrupter mechanism, further rise of the main blade causes an arm on this blade to engage the interruption isolating blade. The two blades then rise together during the final 40 degrees of rotation of the driving insulator to establish the full visible air gap required in the disconnecting switch, (Fig. 3).

Closing sequence

The closing sequence is the reverse of the opening sequence so that the isolating blade is closed and the interrupter contacts made before the main switch contacts are closed. This prevents prestriking or burning of the main switch contacts while energizing a loaded circuit.

Some pertinent features of the sulphur - hexafluoride interrupter are the reciprocating butt-type contacts with a piston and orifice assembly attached to the moving contact. This contact assembly is lifted by an over-center toggle

*Mr. Upton is manager of the Switch, Fuse, and Substation Section of the Assembled Switchgear and Devices Department of Westinghouse.

fill transmission switchgear void

mechanism in the housing at the top of the porcelain. The entire assembly is filled with SF-6 gas to 30 pounds gauge pressure. The moving contact, piston, and orifice move upward as the toggle mechanism is actuated. The upward motion of the piston in the porcelain cylinder creates a high-pressure area above the piston thereby causing SF-6 gas to flow through the orifice where the arc is drawn. The flow of fresh dielectric strength gas through the arc path de-ionizes this path and establishes an insulating medium across the open gap.

The pressure gauge is designed for easy readability and is located at the base of the interrupter so that it may be read from the ground. A filling valve is located adjacent to the pressure gauge and it may be used for refilling after replacement of contacts or for recharging when it becomes necessary. The SF-6 gas is not consumed during arc interruption and it withstands repeated interruption without deterioration. The interrupters are filled to 30 psig at the factory and they will handle their full rating at 15 psig.

One of the important phases of building a line of gas-filled equipment is knowing how to maintain a seal so that the device will have long life and require little field maintenance. The first interrupters experienced a reduction of pressure from 30 psig to 15 psig in a period of three years. Throughout this period they were capable of handling their full interrupting rating. Upon reaching 15 psig it was recommended that the interrupter be recharged to 30 psig. The loss of gas in this situation was not leakage in the usual sense but was molecular diffusion of SF-6 through the gasket material. In most cases the three year period for maintenance was not objectionable; however, it was learned how to build interrupters with much longer life. A gasket material is now being used which is much less permeable, and the leak testing facilities are more sensitive by a factor of 35 to 1. On the basis of these improvements interrupters are now being built which have at least twice the previous operating life before recharging is advisable and the interrupter is now compatible with the most stringent application requirements.

High-speed grounding switches

The field of high speed grounding is not new to the electric utility industry but in the last two years a new approach has been planned and developed so that high-speed grounding has an entirely new appeal. A request was made a utility company to develop a high-speed grounding switch for 196 kv service which would close 20,000 amperes in the very short period of 5 cycles instead of the conventional time of 15 to 30 cycles. Two switches capable of meeting these requirements have been installed.

A high-speed grounding switch is generally used on electric utility systems in order to trip a remote circuit breaker for the purpose of de-energizing an internally faulted transformer which has no local high side breaker protection. A typical case would be in a step-down substation serving a remote industrial site or small community. The economics of the situation is frequently such that a local high side breaker is not justified simply to protect the transformer in the event of an internal fault. The high speed grounding switch in closing thereby creates a line to ground fault which trips the remote circuit breaker and removes the faulted transformer from service before damage to it becomes extensive.

The conventional high-speed grounding switches which have been marketed up to this time have been of the swinging blade type which operate in an interval of 15 to 30 cycles and which have been rated close to 5,000, 10,000, and occasionally 20,000 amperes. The switches are spring closed and manually reopened. They may be used as single phase or three phase devices and may be separately mounted or incorporated as an integral part of an air break or disconnect switch.

This basic approach to high-speed grounding switches has gen-

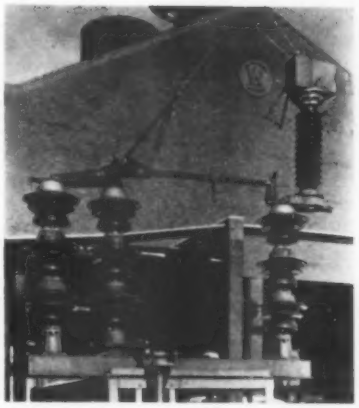


Fig. 1—Type VLB switch is shown here in closed position.

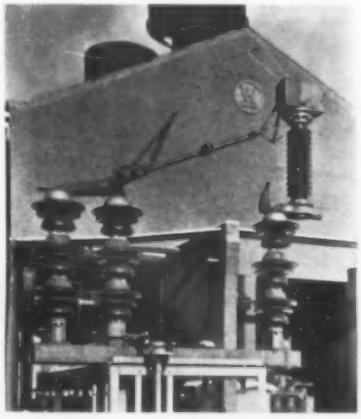


Fig. 2—As interrupter trips.

Fig. 3—Switch in open position.

erally been satisfactory, but with the advent of faster operation of breakers and relays, the conventional grounding switch with its operating time of 15 to 30 cycles becomes obsolete for coordination with the faster acting breakers and relays. Another factor involved in using the conventional high-speed grounding switch is its susceptibility to icing. When in the open position the exposed blades may accumulate an ice load which is much heavier than the blade itself and with a fixed amount of stored energy available to close the blade, it is apparent that the speed of operation would be considerably beyond the limits required for satisfactory service. Thus it is possible that damage to the transformer, which the grounding switch is protecting would be quite extensive.

From the viewpoint of the utility company, the five-cycle grounding switch offers the same degree of protection in regard to operating time as do transfer tripping schemes, and it does this with fewer parts, less maintenance, lower cost, and greater dependability. With the many components involved in carrier current or pilot wire relaying, these systems are likely to be inoperative much more frequently than would be the case with the grounding switch which is a self-contained device and which will function as long as the transmission line itself is in service.

New approach required

In considering the problems to be overcome in this new development, it was felt that a completely new approach was required. Experience in testing the conventional design indicated that it would be impractical to try to pivot a blade or rotate insulators in an attempt to attain five-cycle operation. The operating mechanism, solenoid, latches, etc., consume up to one cycle before the blade begins to move. To accelerate a six- or seven-foot blade required to span a 196 kv insulator stack so that it would pivot closed in our goal of 5 cycles would require tremendous accelerating springs, very heavy latches and shock absorbers, and a rather large diameter blade in order to withstand the rapid acceleration without bending. The large diameter blade, of course, adds weight and is contrary to the solution of the problem. It also seems impractical to consider the possibility of rotating an insulator stack in order to establish a ground circuit. The torsional duty on the insulator stack becomes extreme, and it is doubtful that such a heavy mass could be accelerated and decelerated as rapidly as would be necessary for five-cycle operation.

It seemed desirable to attempt in some manner to minimize the travel of the blade which in turn would minimize time of operation. After careful consideration of the problem and various possible solutions, we decided to use an approach which would provide a reciprocating blade motion in a porcelain weather casing filled with sulphur hexafluoride gas which has excellent dielectric properties. In this manner a high-speed grounding switch designed and built which closes 20,000 amperes, is not susceptible to icing, has minimum travel time and a minimum number of moving parts, and also withstands repetitive operation with a minimum of maintenance. The use of sulphur-hexafluoride gas also minimizes contact burning and allows the stationary contact and moving blade to be positioned much closer than would be possible in air, thereby minimizing closing time. With the past experience of building load break switches using sulphur hexafluoride gas in porcelain-clad assemblies, the problems of sealing the chambers and transmitting motion into the sealed device have been solved.

Figure 4 shows an installation of a 196 kv, five-cycle high-speed grounding switch with manual operating mechanism mounted on a rack at the utility company substation.

The fundamental of this design

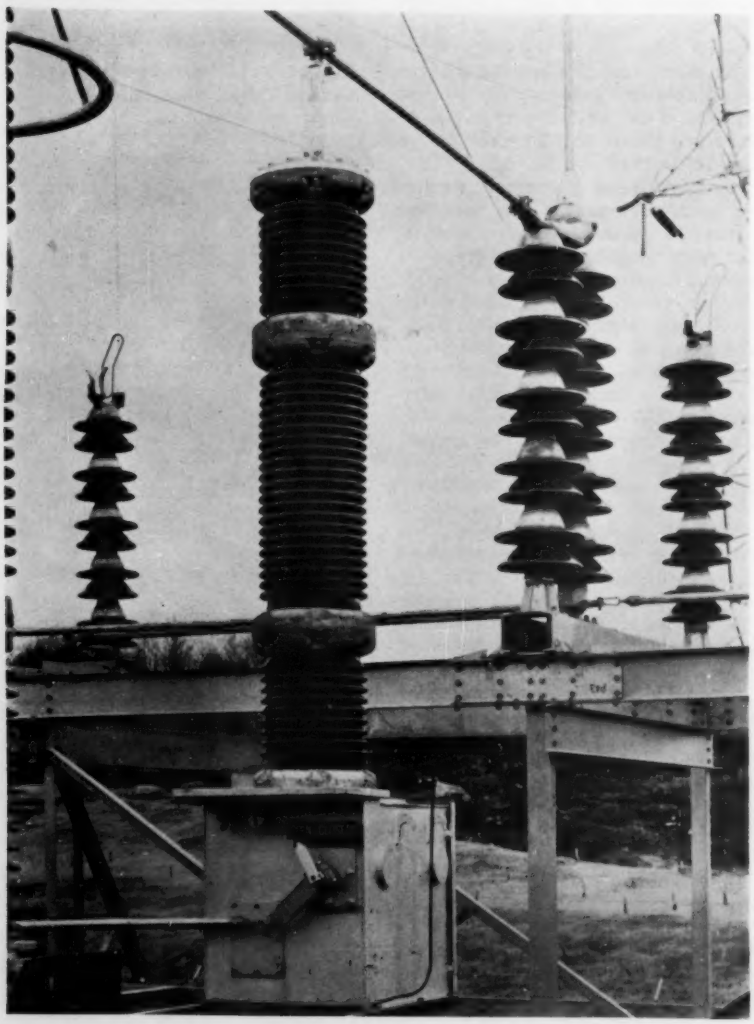


Fig. 4—Five-cycle 196-kv high speed grounding switch.

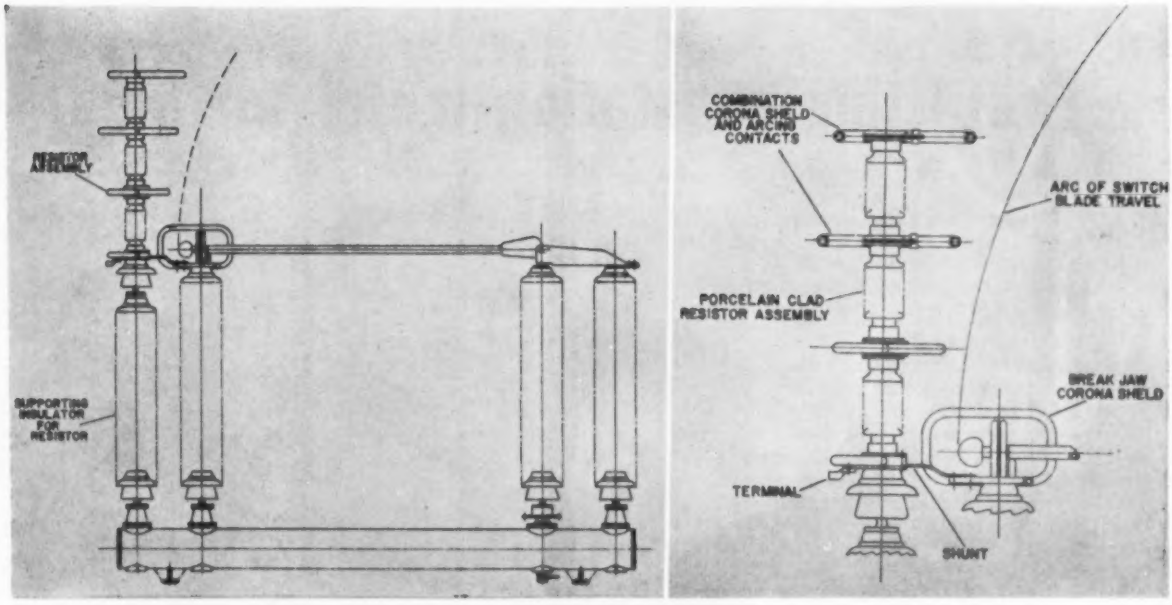


Fig. 5—(Left) Type V switch with surge suppressing resistor. (Right) Detail of suppressing resistor assembly.

is basically a sphere gap in an atmosphere of high dielectric strength sulphur-hexafluoride gas. The spheres serve as corona shields for the contact structures and permit a minimum gap from line to ground thereby minimizing the closing time for the reciprocating blade. A stationary contact structure is housed in the upper sphere and the reciprocating blade is shielded by the lower sphere. The circuit from line potential at the top of the assembly to ground is completed when the spring-biased reciprocating blade thrusts upward to engage the contact assembly and bridge the open gap. This has been done consistently in less than five cycles when closing 20,000 amperes with a 196 kv unit.

The switch is designed to operate at 15 psig pressure of SF-6 gas. It is filled initially to 30 psig to accommodate long-term molecular migration of the gas through gasketing materials. The grounding switch uses the same materials and gasketing techniques as the VLB interrupters and the operating life expectancy before recharging is required is also expected to be at least six years. A pressure gauge is located adjacent to the position indicator so that gas pressure can be checked periodically. A filling valve is beside the pressure gauge and is readily accessible on the ground side of the switch when recharging becomes necessary.

A pressure switch is provided to make the pole unit fail-safe in the event of a fractured porcelain and sudden loss of gas. The pressure switch is calibarted to close at 12-13 psig. It is used to energize the grounding switch while it has sufficient gas to do its full rating.

It is believed that with this design a new trend in high-speed grounding switches for very high-speed operation has been pioneered. The porcelain-clad, gas-filled, pole unit provides a minimum gap from line to ground which is bridged readily in five cycles by a reciprocating blade motion within the porcelain. With the five-cycle grounding switch it is now possible to accomplish remote breaker tripping to protect an internally faulted transformer with no local high side breaker protection in the same time interval as that obtained through transfer tripping schemes. The grounding switch is dependable and will function as long as the transmission line itself is in service; it is not subject to icing, it is economical, and it will stand repetitive operation with only a minimum of maintenance over the years.

Surge suppressing resistors

Switching surges accompanying the de-energization of unloaded lines and cables have become an increasingly important problem, in recent years, in the operation of high-voltage power systems. The use of higher transmission voltages together with the trend toward reduced basic impulse levels of transmission apparatus and reduced voltage ratings of lightning arresters have rendered these systems more vulnerable than formerly to damage from switching surge over voltages.

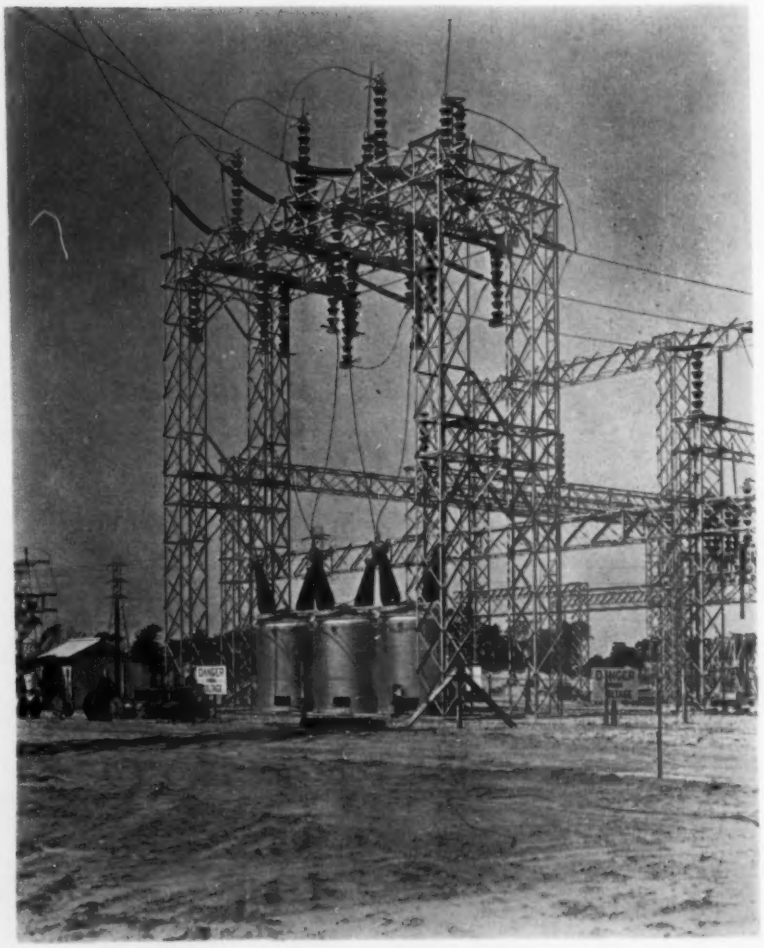
While switching surge phenomena have assumed most prominent importance on 345-kv systems, it has occurred at other voltage levels and is undoubtedly the explanation for a number of apparatus failures at transmission voltages as low as 115 kv. The overvoltage surges resulting from disconnect switch operation are much more damaging to apparatus than are those associated with circuit breaker restriking since there are so many more restrikes resulting from the relatively slow operation of the switch. The causes of a number of major equipment failures have been traced to switching surge overvoltages resulting from no load line switching operations. Consequently, there is a definite need for remedial measures to suppress these overvoltages.

The device described here is designed to provide an economical and dependable means of suppressing switching surge overvoltages caused by arc restriking across the open contacts of high-voltage disconnecting switches 115 kv and above. It consists of a sealed porcelain enclosed resistor assembly mounted on the break-jaw end of a standard high-voltage discon-

(Continued on page 96)

Protecting substation metal surfaces

By Paul C. Ziemke
Clinton, Tenn.



◆ WELL PLANNED maintenance of galvanized and painted surfaces is an important function of the substation and transmission system personnel. Preserving the surface by removing scale and rust, as well as the oil and grease that accumulate, and then applying the recommended type of undercoating and final finish is a means of extending the life of wood and metal structures.

Utility company personnel can take a lesson from shipowners, who are perhaps the best informed about eliminating rust on ferrous metals, since the salt spray leaves them no leisure. They know that one must get down to bright metal before beginning the build-up of new protective coatings. Unless rust is fully removed, its insidious penetration continues, and in due time it manifests itself on the surface by inevitable stains and then blisters.

The shipowner is stuck with the costly and tedious operation of chipping off many old coats of paint that have hardened and must come off. This, fortunately, is not often the case for the electrical industry where the coating is initially the hot dipped zinc, and later the sprayed or hand applied aluminum based paint over red lead or chrome touch-up operations.

Removing paint and rust

Hand brushing with a stiff bristled wire brush gets most of the rust out to reveal the sheen of the parent metal. However, much time can be saved on the large jobs, where perhaps long delay has developed large areas of rust and scale. Here, power driven brushes accomplish as much as three men using hand tools. For the isolated stations, lacking low voltage facilities, a gasoline powered generator is trucked along as part of the equipment.

The oldsters in the business stick by their guns in the use of red lead as the primer. They have known its value for many years but they admit that the light green of the chrome undercoat is more readily covered with one reasonably heavy application of aluminum or gray paint. The dark red of lead shows up at close inspection as "leopard spots."

Giving prompt attention to breakthrough spots on the thin zinc coatings and covering with a matching color will leave the balance of the structure in good shape for many years.

Usually, the defective areas will comprise about 10 per cent of the steel, and if quick steps are taken to coat these, much work is saved. Rust inhibiting paint of a tint closely matching the old zinc is hardly noticeable after a month or two and will restore the structure to a condition closely approximating its original appearance.

Under really adverse conditions of corrosive fumes coupled with abrasives, the steel may have begun to rust and stain the zinc coating. If the area affected exceeds 20 per cent of the over-all area, the original idea of spot painting is no longer practical. In the long run, considering the job of staging, erecting ladders, etc., the one coat job will cost but little more than the touch-up job.

If the zinc has been abraded or eroded to an extent where the rust is evident as pits or pock marks, it will be necessary to thoroughly wire brush the area un-

til the underneath metal gleams. A quick follow-up with the rust-inhibitor primer will seal the spot until it can be covered with the seal coat. In areas of high steel concentration it is possible to hang up canvas screens and perform an effective job of sand blasting.

The paint manufacturers have overcome the handicap of "incompatibility" of their product and the zinc of galvanized finishes. Excellent bonding is now achieved and the paint appears to be almost as durable as the galvanizing. Avoid paints containing inert pigments such as iron oxide, zinc, aluminum, or titanium. A lead-suboxide base paint will last approximately ten years under average conditions.

Red or orange paint

It is becoming a popular practice and a good one to use a red or orange tinted paint to highlight the live busbars and other items under high potential. The U. S. Department of Commerce requires that all transmission towers over 250 feet in height be identified as air traffic hazards by using contrasting colors such as red and white, or white and orange.

Depending on the conditions under which they operate, power transformers need occasional attention to keep them looking good and operating under normal temperatures. Accumulations of combinations of grease, oil, and dust act as insulators that cause undue temperature rise. Frequently little more than cleaning is required. This involves the use of caustic, applied hot, through the use of suitable drums, centrifugal pump, and a source of heat. It is not necessary to spray the caustic on—just flow it on. When the grime is removed a rinsing with fresh, hot water is needed to remove any traces of stripping agent.

Choosing paint

If the original coating is badly weathered and indicates extreme

(Continued on page 101)

Distribution transformers for underground systems unveiled

◆ A COMPLETELY NEW distribution transformer designed specifically for application to underground distribution systems was unveiled by the R T & E Corporation of Waukesha, Wis., and Portland, Ore., in New York on October 9. The initial showing was made to utility executives and representatives of industrial publications.

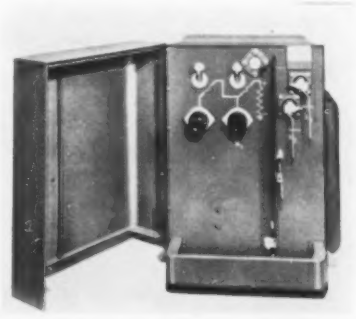
This new transformer, designated the "Terra-Tran," was designed by R T & E in cooperation with engineers of one of the larger utilities to fill utility needs for a distribution transformer designed especially for use with residential and commercial underground distribution systems. It provides, in a compact unit, an economical solution to transformer installations for underground distribution systems.

The transformer is completely self-contained and is designed to be mounted on a concrete pad above ground level. No separate enclosure or protective equipment is required for installation. To protect the public and linemen from accidental contact, all live parts are enclosed in a locked compartment and a welded-on cover is used.

For operation and maintenance, access to the bushings, fuses and disconnects is gained by opening the hinged door on the operating compartment. To facilitate operation, special externally-clamped, high-voltage bushings, designed for easy cable connection, and externally - clamped, high - voltage bushings are used.

A unique high-voltage fuse of new design, for isolating the transformer from the line in the case of a transformer failure, is supplied on protected-type transformers. It is of bayonet design and can be removed externally for replacement of the fuse element. In conjunction with this externally-replaceable fuse, an externally-operated bayonet-type disconnect switch has been developed to sectionalize portions of the circuit.

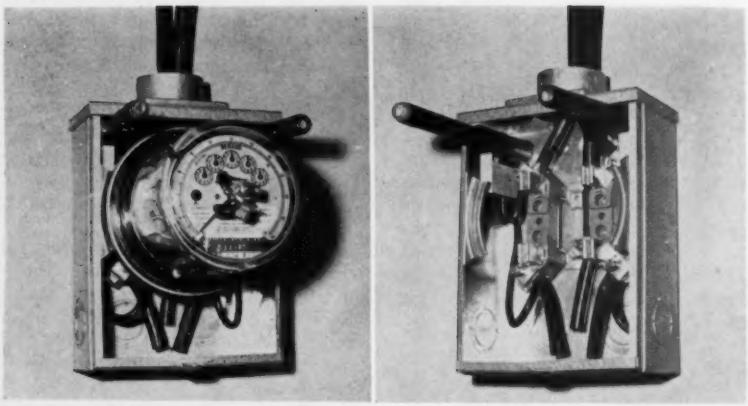
In addition to the many technical developments for making this transformer easy and inexpensive to operate and maintain, R T & E engineers have given much consideration to making the unit as attractive and inconspicuous as possible. Its design is pleasing in appearance and it is painted in a color to harmonize with its setting. The "Terra-Tran" will be available initially in single phase units in a range of sizes from 15 kva through 100 kva for operation on 4160 ground Y/2400 through 12470 ground Y/7200-volt, grounded Y systems. It will also be available in 3-phase units in a range of sizes 75 kva through 300 kva for operation on all standard 2400 through 14400-volt, 3-phase systems.



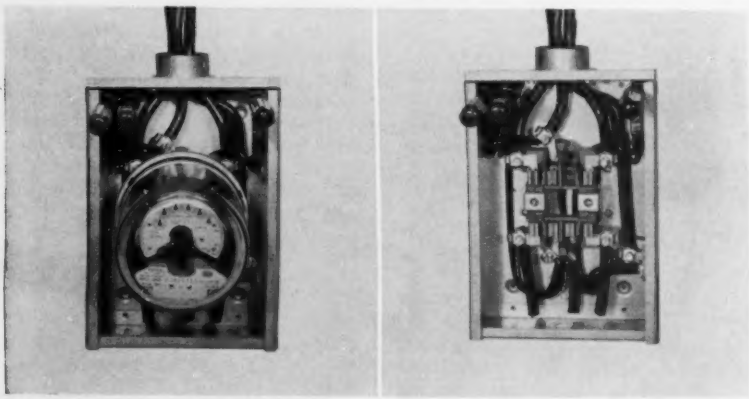
Interior view of new "Terra-Tran" for underground distribution. Clearly visible are unique externally replaceable bayonet type primary fuse and externally operated disconnect switch.

RT&E Corporation's new "Terra-Tran" for application to underground distribution systems. No separate enclosure is required for this unit, which mounts on a concrete pad above ground level. All live parts are safely enclosed.

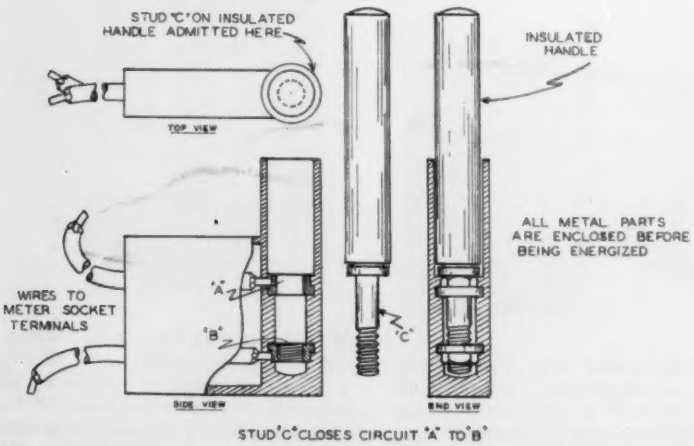
Meter by-pass eliminates scattered interruptions



Single-phase socket with plugs working in by-passes.



Three-phase socket with plugs working in by-passes.



Construction details of by-pass and by-pass plugs.

By C. E. Sloop
Division Meter Supt.
Georgia Power Company
Columbus, Ga.

◆ CONTINUITY of electric service is often taken for granted somewhat like air and water. Only when it fails do we realize how dependent our customers are on our electrical service.

Retailing is highly competitive. A successful business starts with a smart merchandise display, aided and abetted by good lighting and air conditioning. Momentary interruptions are disconcerting and may be the reason for a lost sale.

The apartment dweller today is electrically well automated. A momentary interruption plays havoc with a cake or pan of biscuits in the oven, and for the same reason it doesn't help the "old man's feelings coming home from a hard day at the office to get stuck mid floors on the elevator.

In each case it may be only a short interruption, just while the power company necessarily changed a self-contained socket type meter. The well known advantages of the socket type meter have made its use a must with the utilities, yet the meter can not be tested, changed nor the connections inspected without the customer's service being interrupted. The customer's practice and affairs actually take place with and following the use of electric service. Any interruption is viewed with displeasure.

The minutes of meter committees, national in scope, reveal they have all been searching for a meter socket by-pass. All types have been considered. Either they don't offer enough, have failing parts, or the cost is excessive.

I have developed a simple by-pass for self-contained meter sockets (patent pending). It has all the requirements sought for so long, and will even attract the utilities who are at present not interested in by-passes. It operates in all ringless and certain ring type sockets.

Its advantages are:

(1) Absolute safety from shock or flash is assured by all live parts being enclosed before any contact.

(2) Low cost is assured, since the outer covering is synthetic rubber or a plastic, and the small amount of metal used is simple in application.

(3) It has no springs nor moving parts to fail, its metal and insulation comprise one rigid piece that has no movement.

(4) The by-pass can not come on unexpectedly. All action awaits the hand application of a threaded one piece bolt plug.

(5) Access to this by-pass is from front of socket. No worry, ever, from lack of room on the sides.

(6) Unattached (except by its leads), this by-pass is free standing in the unused interior spaces of the socket. No wall space is required other than for the socket.

(7) Meters often are in poorly lighted rooms or basements. This by-pass requires only semi-light to see the hole provided to admit the screw plug.

(8) This by-pass works in individual single phase sockets, in single phase gang sockets, and three phase sockets.

(9) This by-pass is easily installed in sockets on customer's premises, either those already working, or new ones in the process of being installed. They may be installed in utilities' warehouses, or before the sockets leave their manufacturer.

(10) This by-pass has class 200 capacity.

A utility is faced with the probability of having many by-passes installed on its system. Economy decrees the first cost be low. Natural expectations are they will be in service continuously without disappointment. Then, while the use of each by-pass is most infrequent, it is of major importance at the moment used. Without it the simultaneous use of service and removal of meters can not be had.

No utility executive ever knows the extent of regret from the practice of those scattered interruptions. In the long past they were expected, today they are only impatiently tolerated. But in our bright future, well, service must be better.

Transformers and breakers now can use same bushings

◆ A NEW LINE of standard high-voltage bushings—all of them completely interchangeable between transformers and circuit breakers—has been announced by General Electric.

Called TBI (Transformer-Breaker Interchangeable) bushings, only eight basic bushings will cover all applications in the standard voltage classes from 23 to 196 kv, inclusive.

ASA standards for outdoor apparatus bushings recently adopted (C76.1a-1958) provide 37 different bushings in this range. From 23 to 69 kv, four are designated as transformer and circuit breaker bushings, and 20 are for transformers only. From 92 to 196 kv, thirteen designs are permitted, six being interchangeable and seven being for transformer use only.

TBI bushings meet the ASA standards in all respects, but provide the additional feature of complete interchangeability which is not assured by the standards. To achieve this, two major steps were taken.

1. A complete design study was made of G-E power transformers, medium transformers, and oil circuit breakers and major changes made where required so that bushings with the same ground sleeve and the same length below the cover can be used for all apparatus.

2. Each TBI bushing has a dual current rating, 400/1200 amps in the 23 to 69-kv range, and 800/1600 amps in the 115 to 196-kv range. The current rating is determined by the terminal accessories, since in all TBI bushings the conductor inside the bushing is designed for the maximum current. To convert from one application to the other, all that is required is to change terminal accessories.

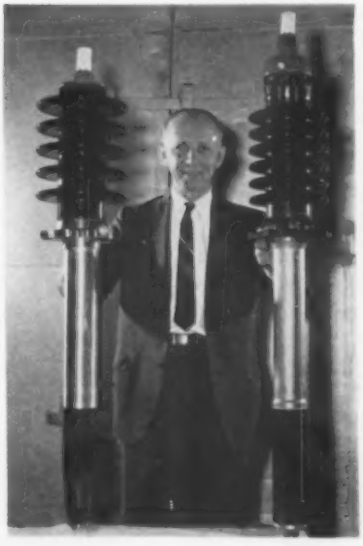
TBI bushings may be specified for General Electric power transformers, medium transformers, and high-voltage circuit breakers starting in the first quarter of 1959, the company announced.

The principal benefit of interchangeability to utilities is the great potential savings in spare bushing inventories. With only 8 basic bushings for the entire 23-196 kv range, rather than the several hundred types used in the past, conservative estimates indicate that the utility industry should save $5 million or more within the next few years.

Other advantages are better service in emergencies because overnight air cargo service could supply any TBI bushing directly from factory stock; simplification of ordering and stocking because of a great reduction of catalog numbers; and the prospect of continued low price levels from economies of large-volume manufacturing.

Since the basic difference between transformer and breaker application is the current rating (breakers need the higher current capacity) the key to interchangeability is the dual current rating, G-E engineers explained.

In all eight voltage classes, 23, 34.5, 46, 69, 115, 138, 161, and 196 kv, the TBI design has a hollow conductor. For use in breakers, the bushing can be connected at the bottom to the breaker interrupter; in transformers, the transformer draw lead can be pulled



TBI bushing, right, replaces Type LC bushing, left, and can be used in either transformers or circuit breakers. The model shown by Stephen Terpak, product engineer, is rated 34.5 kv, 1200 amps.

up as usual through the hollow conductor and connected at the top.

The TBI bushing design employs the latest research and engineering developments, including an oil impregnated, lined paper core with voltage stress equalizers in the form of Rescon lines printed on the paper. Radial voltage stress is divided into thousands of segments, with an infinitesimal voltage gradient between adjoining pairs, improving performance, decreasing size and weight, and enabling G-E designers to make room for the hollow conductor and still stay within the ASA standard dimensions.

Another innovation in the line is the addition of liquid level indication in the smaller sizes, which was not practical in the past. A thick walled glass expansion chamber is bonded on the top of the porcelain shell and serves as an integral part of the insulating structure. Being transparent, the glass affords ready visibility of the liquid level.

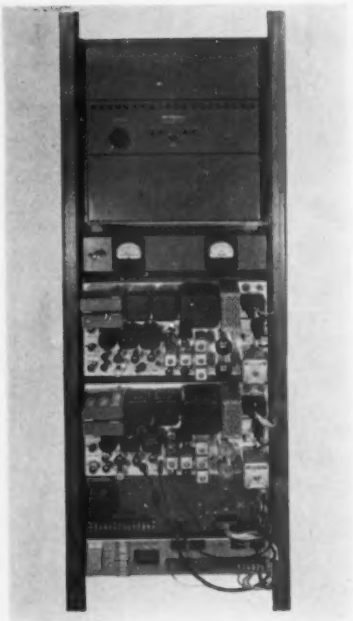
Remote centralized control for distribution system capacitors

◆ A CAPACITOR switching system providing a practical method of automatic, centralized control of remote capacitor banks in electrical utility systems has been introduced by Motorola. The switching is accomplished through transmission of code tones by carrier on the feeder lines to transistorized receiver-decoders located at the remote capacitor sites.

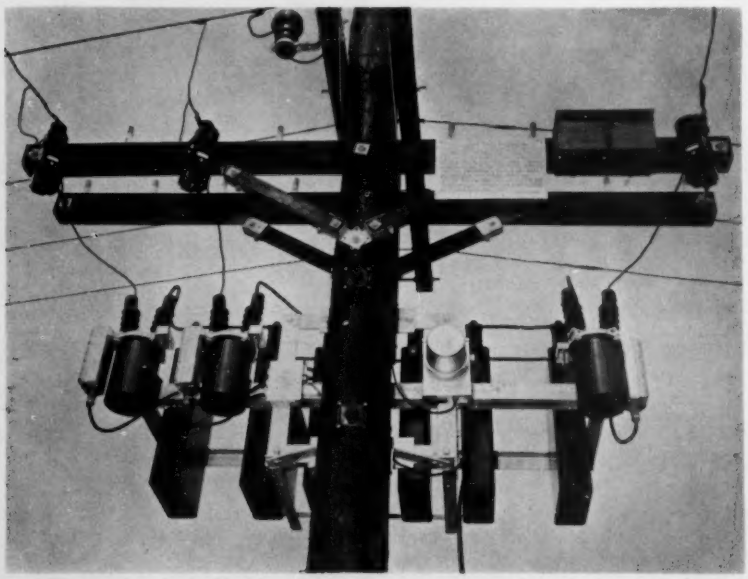
A programmed coder unit and various accessory panels, besides the power line carrier transmitter, make up the central station equipment. A receiver-decoder unit is all that is needed at the remote locations.

When system voltage or reactive measured at the substation bus exceeds preselected limits in either direction, the coder initiates action to add or remove capacitor banks from the line.

Two "Vibrasender" tone generating devices (for open and close signals) are provided in the coder for each controlled capacitor bank or group of banks. The devices are programmed in the desired sequence in which the capacitor banks they control should be added to the line. The sequence can be easily changed by interchange of the plug-in, hermetically sealed units.



Shown here is the central station equipment rack for the capacitor switching system. The top unit is the program coder; the row of lights indicates the number of capacitor banks on the line. Below the coder are the power supply, FM power carrier transmitter, etc.



The receiver-decoder unit of the new Motorola capacitor switching system is shown in a typical installation. Housed in a watt hour meter case the receiver-decoder controls the bank of capacitors here.

When the need for additional capacitance is sensed, "close" tones are generated and transmitted in the preset sequence until enough capacitor banks are switched on to the line to bring reactance or voltage within the required limits.

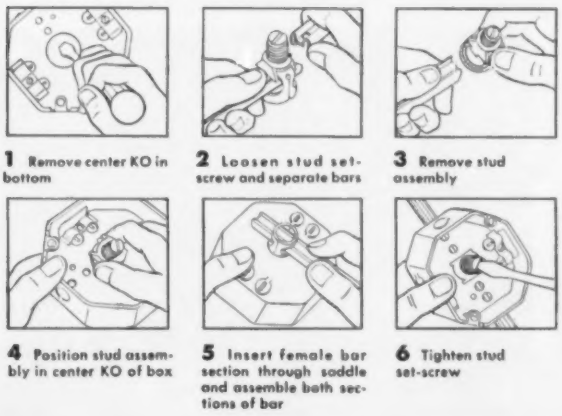
Vice versa, when removal of capacitors is necessary, "open" tones are transmitted in reverse sequence or "last on—first off" sequence until conditions are again within desired limits. Manual control is also available for special switching and testing functions.

The tone signals are transmitted by a standard Motorola 10-watt carrier transmitter. The signals are received at the capacitor sites through a ferrite-core inductive antenna mounted between the pole lines. No connection is made to the

(Continued on page 96)

Assembled . . . Ready For The Job!

AVOID THESE COSTLY STEPS ON THE JOB BY USING RACO SET-UP BOXES!



1 Remove center KO in bottom

2 Loosen stud set-screw and separate bars

3 Remove stud assembly

4 Position stud assembly in center KO of box

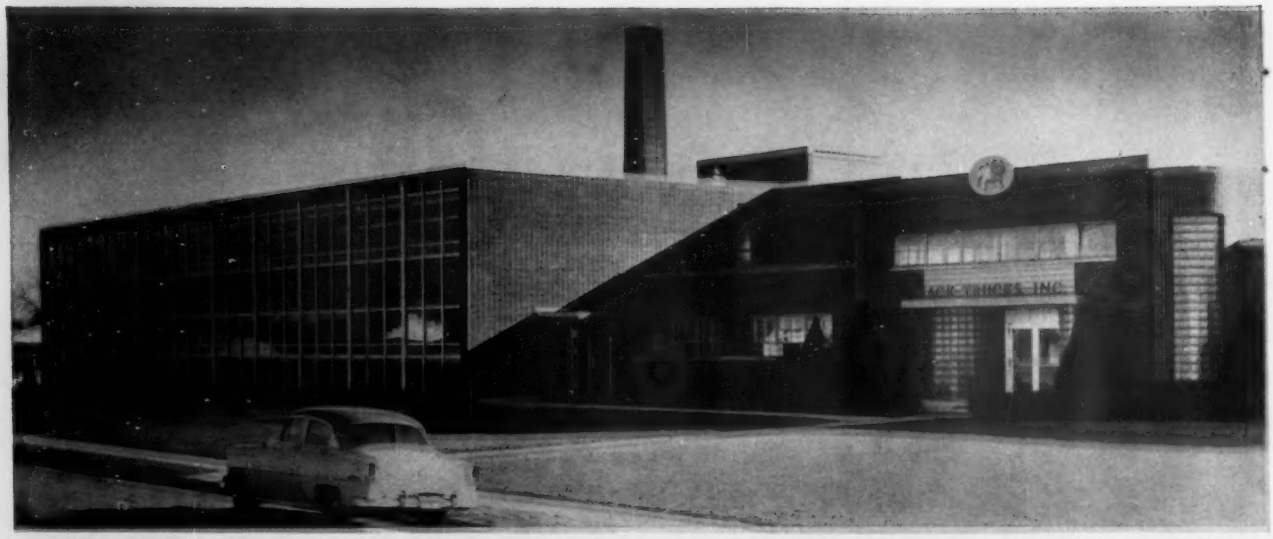
5 Insert female bar section through saddle and assemble both sections of bar

6 Tighten stud set-screw

It costs you 12¢ at average labor rates, to have your men assemble a box on a bar. You can buy the same box and bar factory assembled for an assembly charge of about 2¢. You save 10¢ on every set-up box you install . . . a substantial dollar savings to add to your profits.

YOU CAN'T ASSEMBLE FOR 2¢! TRY IT!

ALL-STEEL EQUIPMENT INC.
Aurora, Illinois



Ⓐ Aluminum PowerPlugin duct everywhere in this new building guarantees full power efficiency.

Ⓐ Aluminum PowerPlugin Busduct installs, easily, quickly, inexpensively.

NEW MACK TRUCK PLANT INSURES TOP POWER FLEXIBILITY, LOWER COSTS WITH...

FRANK ADAM *Aluminum* BUSDUCT

MACK TRUCKS, INC.
Sidney, Ohio

Engineers:
Schweiger & Heapy
Dayton, Ohio

Electrical Contractor:
Sidney Electric Co.
Sidney, Ohio

No gambling here with inefficient power distribution! Mack Truck gets the most from every electrical dollar with (FA) Aluminum PowerPlugin Busduct—ultimate in power efficiency.

With new (FA) Aluminum PowerPlugin Duct, Mack Truck enjoyed the advantages of a lower-initial cost *plus* substantial savings in installation time because of lighter weight and easier handling. New circuits can be plugged in fast for new machines or for relocating old without production loss—plant layouts can be quickly changed; the whole distribution system can be increased or altered virtually overnight. Eliminated are temporary connections and long lead-ins that cause voltage drop and production slow-ups.

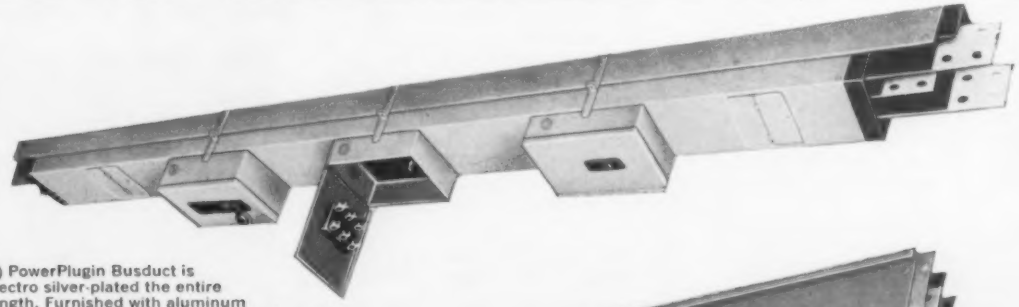
Specify (FA) Aluminum Busduct on your next project—give your customers the best.

Write for catalog data

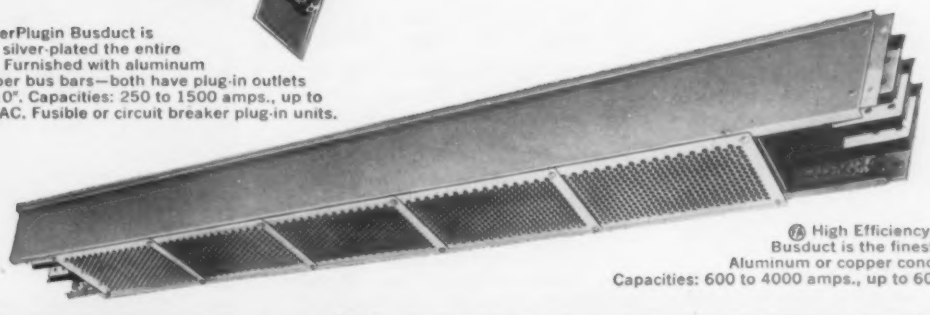
FRANK ADAM

(FA) Products are the sign of a better job

FRANK ADAM ELECTRIC COMPANY
P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MISSOURI
busduct • panelboards • switchboards • service equipment
safety switches • load centers • Quikheter



(FA) PowerPlugin Busduct is electro silver-plated the entire length. Furnished with aluminum or copper bus bars—both have plug-in outlets every 10". Capacities: 250 to 1500 amps., up to 600-v. AC. Fusible or circuit breaker plug-in units.



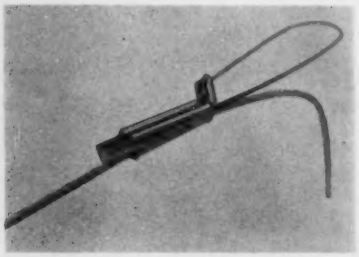
(FA) High Efficiency Feeder Busduct is the finest made. Aluminum or copper conductors. Capacities: 600 to 4000 amps., up to 600-v AC.

Notes on new utility equipment

Wedge clamp saves service and installation time

A NEW WEDGE GRIP clamp for triplex service drops that will save installation and service time and cut labor and material costs has been recently offered by Porcelain Products Inc., Carey, Ohio.

Porcelain Products' No. 1060 wedge grip clamp is made entirely of stainless steel and heat-treated

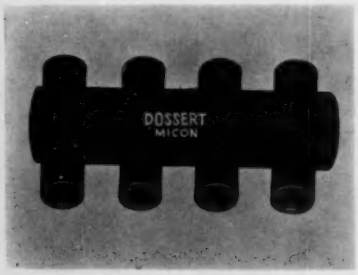


aluminum for greater strength and the highest rust and corrosion resistance. For use at the pole and house end of a triplex service drop, the 1060 wedge clamp can be installed with less effort and once up, will stay up. Because of its compactness and its simplicity of design, it can be installed with line gloves on, as all parts stay together while handling the clamp. The 1060 clamp can be re-used as it will never become deformed or distorted, even under maximum loading.

For additional data, ask for item U-1101, using the coupon on page 103.

Connector designed for industrial applications

THE MICON CONNECTOR from Dossert Manufacturing Corp., 249 Huron St., Brooklyn, N. Y., is designed for use with underground distribution networks or industrial applications.



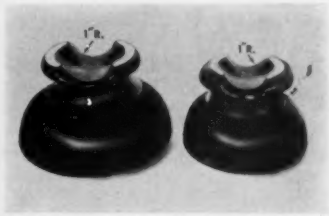
It is used for joining 2 to 18 electrical cables where a fully insulated, watertight electrical connection is required. It is essentially a preinsulated bus bar to which cables are connected by means of mechanical cable receptacles.

The insulation is molded on the connector in such a manner as to eliminate all crotch taping which is a tedious and time consuming operation. Two insulating materials are available which are Mypar, a natural rubber compound and Myprene, a synthetic rubber compound. Both of these insulating materials are specially compounded for exceptional dielectric and aging properties. A newly developed molding process permits the insulation to be fully molded over the connectors without seams or factory taped joints.

For additional data, ask for item U-1102, using the coupon on page 103.

Pin-type insulator made of wet-process porcelain

PORCELAIN PRODUCTS, Inc., Parkersburg, W. Va., is now offering a pin-type insulator with a one-inch wire-groove radius that accommodates ACSR and all-aluminum up to 795,000 over rods.



The insulators are available in radio-free or plain types, and have characteristics comparable to the present EEI-NEMA 55-4 and 55-5.

They are made of high-quality wet-process porcelain with a minimum side groove of 5/8".

For additional data, ask for item U-1103, using the coupon on page 103.

Clamps provide a saving of triplex drop cable

THREE NEWLY-DESIGNED types of neutral mid-spin clamps, for use with open wire or triplex secondaries, were recently announced by Anderson Electric Corporation, 700 N. 44th St., Birmingham, Alabama, manufacturer of electrical equipment.

The neutral mid-span clamps may be used just "off the pole" to eliminate brackets, knobs, etc., thereby providing additional climbing space on the pole. The use of a mid-span device will provide a saving of triplex drop cable since direct secondary house runs can be made from these clamps. The eyebolt provides a terminal for a positive bonding of the neutral of the house service to the secondary neutral.

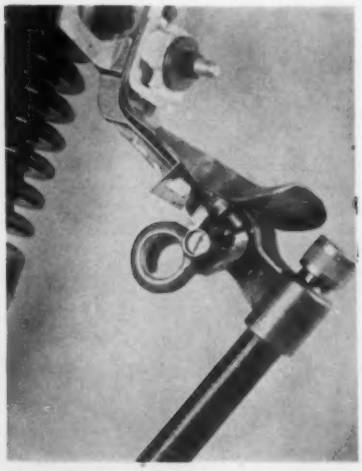
The heavy dead-end eye is supplied to the secondary neutral for the purpose of taking bails or for inserting thimbles up to ½ inches for serving cable. The clamp is designed for #4 to 2/0 ACSR mains and #8 to 1/0 ACSR taps. All cable openings are heavily flared for protection of the cable.

For additional data, ask for item U-1104, using the coupon on page 103.

Gas blast breaks load on open cutouts

OPEN CUTOUTS are now available with a gas load break device similar to that introduced on enclosed cutouts last year are now available from General Electric, Schenectady 5, N. Y. A small replaceable gas filled monel cylinder mounted in the top of the new fuseholder makes each open type cutout a load break switch.

When the cutout is opened in the normal way with a switchstick, the action of the switchstick moves the gas filled cylinder into the load break position. As the cutout is opened the tip of the gas cylinder is the last part of the fuseholder to leave the upper contact. The load current arc is drawn between the cylinder tip and the upper contact, burning the cylinder tip open. This releases a jet of compressed insulating gas which extinguishes the

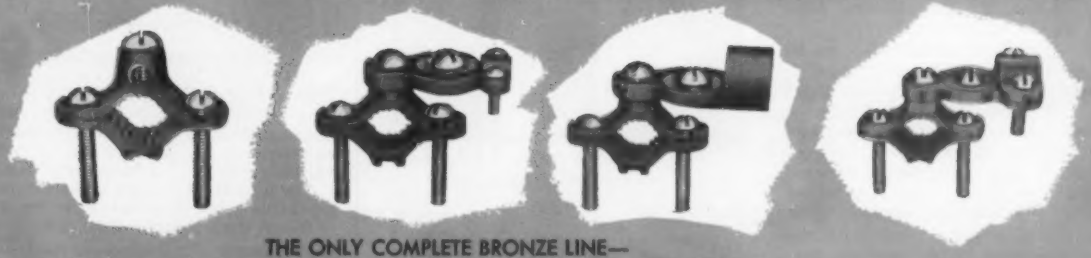


arc. The load break operation can be performed with any conventional switchstick.

The gas load break cutout makes

YOUR "GOLD MINE" OF PROFITS

WEAVER
CAST BRONZE GROUND CLAMPS



THE ONLY COMPLETE BRONZE LINE—
for ¼" to 4" copper tubing or galvanized pipe.

ONLY 4 TYPES TO STOCK—
to cover all water pipe grounding jobs.

THE HIGH QUALITY LINE—all-bronze for long life, no rusting—simple design—smooth, clean finish.

SWINGING TOP—cuts installation time.

PRICED TO SELL—lower than other leading clamps . . . but with a "good-as-gold" margin for you.

WRITE FOR FREE SAMPLES OF WEAVER GROUND CLAMPS TODAY—GET SET TO STOCK YOUR SHELVES WITH SALES

NOTE: Cadmium plated at no extra cost if required.

J. A. WEAVER Company

2110 HOWARD ST. ST. LOUIS 6, MO.

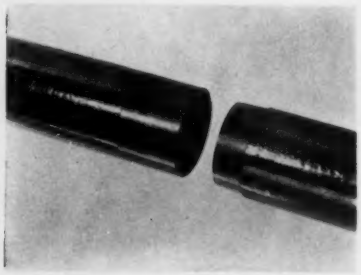
CE 1-8100

possible a low cost load break switch at each cutout installation without the complication of any additional device. Feeder or branch lines may be disconnected for maintenance or repair without having to open the substation breakers and interrupt service to other parts of the system. The cutouts require no special maintenance.

For additional data, ask for item U-1105, using the coupon on page 103.

Conduit available with new-type flush coupling

ORANGEBURG MANUFACTURING Co., Inc., Orangeburg, N. Y., has announced availability of their standard fibre conduit—for concrete encasement—with a new-type flush



coupling attached to each length at no extra cost.

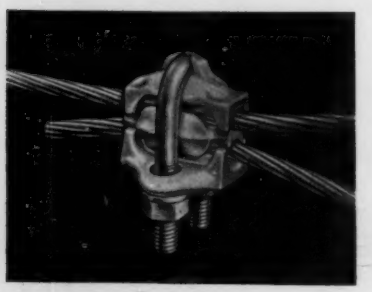
The new development, known as Orangeburg CA Conduit, cuts laying time up to 26 per cent by eliminating assembly of separate couplings on the job.

This new-type coupling, made from an exceptionally tough plastic, produces a self-sealing, water-tight joint. The flush coupling eliminates the necessity of staggering joints in the trench and means less tooling on the job. It also eliminates separate coupling cartons, thus reducing handling and storage requirements. The new coupling fits flush with the outside diameter of the conduit, permitting storage in even stacks.

For additional data, ask for item U-1106, using the coupon on page 103.

Dead-end clip for use when cost is a consideration

THE BURNDY CORP., Norwalk, Conn., has designed a new dead-end clip for secondary distribution deadending and tap applications where cost is a major consideration. The Clipit, type UW-R, is a high strength aluminum alloy connector. Two sizes cover cable range #6 through 2/0 aluminum or 1/0 ACSR. Said to exceed the rated breaking strength of ACSR cable on most sizes, the Clipit has captured galvanized steel U-bolts that permit high tightening torque.

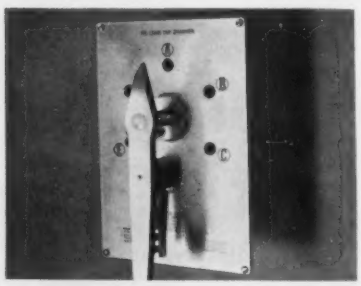


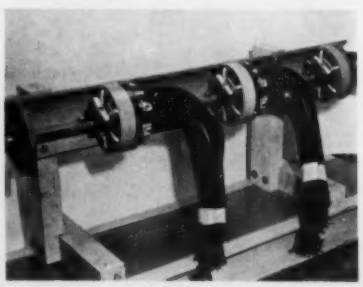
Easy installation is promoted by mutual self-aligning parts and ears of caps that confine cables, preventing cable splaying. Stress points and cold flow are minimized by wide belled cable entrances. Generous wrap-around spacer permits use of Clipit as a tap connector. Clipit is coated with corrosion inhibiting compound.

For additional data, ask for item U-1107, using the coupon on page 103.

Tap changer has quick-disconnect feature

A NO-LOAD tap changer, embodying a new design, is now standard equipment on all Kuhlman substation transformers, it was announced by Joel Watkins, manager of the Transformer Division of Kuhlman Electric Co., Birmingham, Mich.





The new tap changer is so constructed that the rotor contacts function as free-acting crosspin universal joints. The free action assures positive contact and eliminates the problem of misalignment between rotor and stationary contacts.

The pistol grip handle has a trigger release which allows the changer to be moved to the desired position. Once in position, the trigger plunger snaps into a stop.

For additional data, ask for item U-1108, using the coupon on page 103.

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Plan to stay ahead... MODERNIZE!

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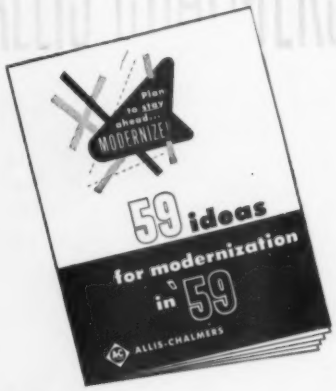


NEW brochure of ideas for modernizing

This booklet is based on the premise that modernization can start anywhere in your plant. It can be a single machine or operation . . . a better way of getting variable speed . . . a faster way to braze . . . or a newly available replacement. In fact, this type of updating is far more common than the sweeping change.

Get a copy of "59 ideas for modernization in '59" from your nearby A-C office or write Allis-Chalmers, Industries Group, Milwaukee 1, Wisconsin.

New motor development may eliminate premiums you've been paying for specially protected motors.

Electrical modernization includes placing substations close to machines being served.

ALLIS-CHALMERS

A-5850

There's a good reason WHY...

ALLIS-CHALMERS uses

CURVACORE DESIGN

in distribution transformers

HIGH PERMEABILITY,

low losses, extra strength

CURVACORE design fully utilizes the advantages of cold-rolled, oriented steel. It permits the flux path to follow the grain of the steel. This results in low exciting current, low hysteresis and a mechanically stronger core structure of less weight. *In addition,* coils are arranged in low-high-low sequence which gives lower impedance resulting in better regulation. Liberal cooling ducts provide large contact areas between windings and oil . . . keep copper-to-oil gradient low.

For *all the good reasons why* Allis-Chalmers distribution transformers deliver outstanding performance for many trouble-free years, ask your A-C man. Or write to Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Curvacore is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5721

Bathroom heater offers safety, style features

ALLIED PRECISION Industries, Inc., Geneva, Ill., has announced the manufacture of their new No. 3100 electric bathroom heater. The surface-mounted unit is of polished anodized aluminum construction.

The Radiantglass panel features a Corning Glass Pyrex heating element, and is protected by a safe, highly polished grill that will not heat up. A built-in thermostat allows exact temperature selection. Surface mounting makes unit easy to install.

The heater is available in 120 or 240 volts; 2650 BTU's per hour. It is 13½" wide x 17¾" high x 3" deep.

For additional data, ask for item U-1109, using the coupon on page 103.

Photo electric control features easy installation

NEW PHOTO ELECTRIC control is available from Precision Magnetic Controls, Inc., 34 Cottage Pl., Ridgewood, N. J. Control features two precision-engineered components—a single-throw integrating relay and a light-sensitive photo cell. The photo-

electric cell de-energizes and energizes the integrating switch to close and open circuits at pre-determined natural light levels. Control's simplicity reduces initial cost.

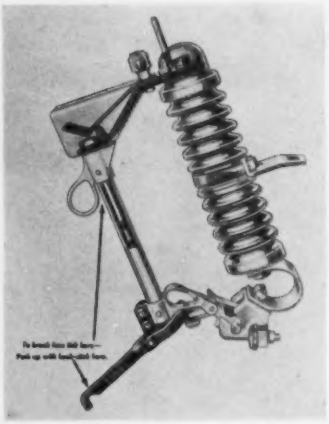
The miniaturized unit (2¾" x 1¾") is rated at 105-130 volts, 25/60 cycles; maximum direct lamp load is 1800 watts.

It features easy installation. Polarized prong arrangement assures positive positioning. Pole top, cross arm, bracket arm, wood pole, luminaire, other mountings are available.

For additional data, ask for item U-1110, using the coupon on page 103.

Load break lever provides simple and easy operation

A SIMPLE, LOW COST, mechanical load break, that can be attached, in a matter of minutes to any Hubbard Faultmaster cutout regardless when installed, has been developed by Hubbard and Co., 200 S. Michigan



Av., Chicago 4, Ill. When equipped with this load break lever the Faultmaster cutout becomes a safe, positive load interrupter under any rated load.

Operation is simple and easy. It is safe because lineman's spurs are more deeply embedded with the upward thrust of the hook-stick which maintains tight, positive contact with the load break lever. The upward thrust of the hook-stick breaks the fuse inside the tube for safe, positive interruption.

For additional data, ask for item U-1111, using the coupon on page 103.

Several lines of connectors first in expanding program

ENTRY INTO the underground field by Anderson Electric Corporation, 700 N. 44th St., Birmingham, Ala., has been announced by C. E. Bitzer, vice-president of sales. Several lines of connectors mark the first step in Anderson's expanding program to bring to its customers a complete and advanced line of underground connectors and fittings.

Type HU insulated compression connectors are economical and quickly installed. The HU connectors are designed for use in joining secondary network cables at junction points. They are completely insulated with P-40 Performite rubber coated with neoprene, available with four to twelve cable outlets, and installed with standard indent tools.

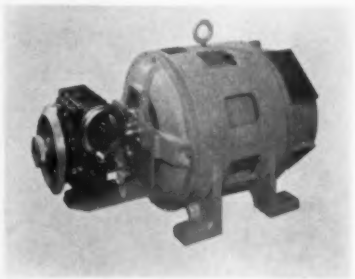
Type HCL compression lugs are designed to accommodate copper cable from #6 through 2000 MCM. They can be installed with standard indent tools, also.

Split tinned copper connectors are manufactured in accordance with the latest EEI specifications from high conductivity copper, hot dip tin plated.

For additional data, ask for item U-1112, using the coupon on page 103.

New 2000-volt ampere phase shifter announced

THE STATES Co., 19 New Park Ave., Hartford, Conn., manufacturers of a wide line of electrical testing equip-



ment, offers their 2,000-volt ampere type R phase shifter which provides phase displacement from 0 to 360 degrees. The States type R phase shifter may be obtained in capacities of 50, 200, 300, 500, 1000, and 2000-volt amperes.

For additional data, ask for item U-1113, using the coupon on page 103.

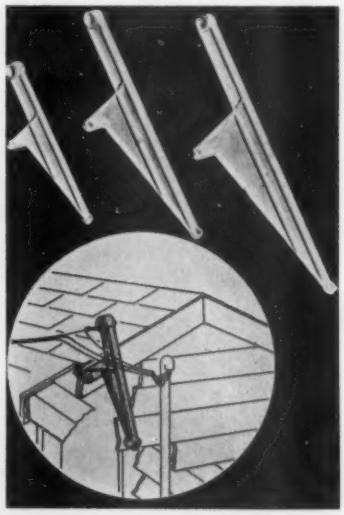
Powerline support bracket completely safety tested

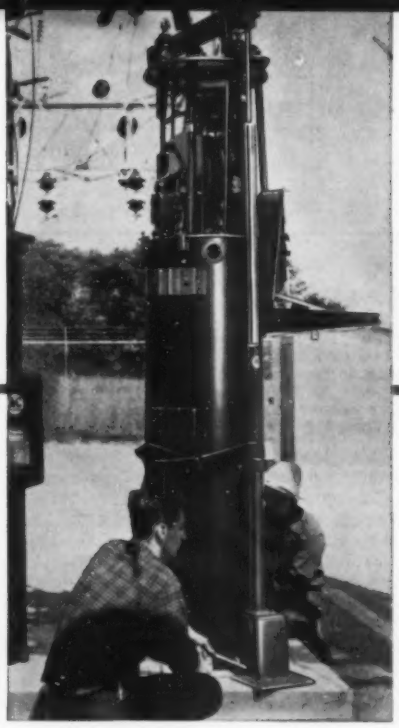
A NEW TYPE of electrical powerline support bracket is being manufactured by the Powerline Support Co., P. O. Box 227, Fairborn, Ohio.

The support permits greater flexibility in attaching the electrical service drop to buildings and homes by allowing a 360 degree approach of the triplex cable. It also eliminates the need for holes through the roof as required in service mast installations.

The support is cast of a durable noncorrosive aluminum alloy. Manufactured in a variety of sizes, it has been completely safety tested by an independent testing laboratory.

For additional data, ask for item U-1114, using the coupon on page 103.





Plan to stay ahead... MODERNIZE!

Convenient, easy-to-use hydraulic untanking jacks are available to all Allis-Chalmers regulator users.

Mobile unit carries all needed tools and repair parts. Oil storage tank, filter press and dielectric oil tester are in trailer.

ALLIS-CHALMERS

NEW Field Service Unit

combines regulator training and service

Mobile service unit brings trained service personnel and instruction on preventive maintenance to regulator site.

THIS mobile unit has proved to a growing list of utilities the economy of preventive maintenance on a planned program.

Utilities are encouraged to have their own men participate for training.

The service includes detailed inspection of mechanism, checking band width, voltage level, and relay contacts, retouching paint, replacing parts and filtering oil if necessary . . . thus extending regulator life . . . eliminating potential troubles.

All service, whether for single or three-phase regulators, is done at the regulator site. Full advantage is taken of *unit construction* of Allis-Chalmers regulators. Downtime is reduced.

See New Movie

Additional information in colored 16-mm sound film can be obtained by contacting your nearest A-C office or writing Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5584

New, revised estimating tables continued in this issue

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

MOTOR INSTALLATION MOUNTING & CONNECTING
220 VOLT INSTALLED ON FLOOR

MOTOR SIZE	HOURS Ea.	LABOR COST INSTALLED EACH AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
1	4.7	5.88	7.05	8.23	9.40	10.58	11.75	12.93	14.10	15.28	16.45	17.63
2	5.5	6.88	8.25	9.63	11.00	12.38	13.75	15.13	16.50	17.88	19.25	20.63
3	6.4	8.00	9.60	11.20	12.80	14.40	16.00	17.60	19.20	20.80	22.40	24.00
5	7.6	9.50	11.40	13.30	15.20	17.10	19.00	20.90	22.80	24.70	26.60	28.50
7½	10.5	13.13	15.75	18.38	21.00	23.63	26.25	28.88	31.50	34.13	36.75	39.38
10	13.5	16.88	20.25	23.63	27.00	30.38	33.75	37.13	40.50	43.88	47.25	50.63
15	16.5	20.63	24.75	28.88	33.00	37.13	41.25	45.38	49.50	53.63	57.75	61.88
20	20.5	25.63	30.75	35.88	41.00	46.13	51.25	56.38	61.50	66.63	71.75	76.88
25	24.3	30.38	36.45	42.53	48.60	54.68	60.75	66.83	72.90	78.98	85.05	91.13
30	28.5	35.63	42.75	49.88	57.00	64.13	71.25	78.38	85.50	92.63	99.75	106.88
40	33.9	42.38	50.85	59.33	67.80	76.28	84.75	93.23	101.70	110.18	118.65	127.13
50	42.6	53.25	63.90	74.55	85.20	95.85	106.50	117.15	127.80	138.45	149.10	159.75
60	52.3	65.38	78.45	91.53	104.60	117.68	130.75	143.83	156.90	169.98	183.05	196.13
75	64.5	80.63	96.75	112.88	129.00	145.13	161.25	177.38	193.50	209.63	225.75	241.88
100	86.6	108.25	129.90	151.55	173.20	194.85	216.50	238.15	259.80	281.45	303.10	324.75

E-101-B

LABOR: INCLUDES PREPARATION TIME, HANDLING MOTOR AT SITE, SETTING TO POSITION, SECURING IN PLACE AND CONNECTING TAPS.

11-58

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No. 10 in a series

Right off the Wire

A miniature record player only four by eight inches is capable of playing twelve inch records.

&

The record of many thousands of electrical installations shows that the use of TIREX cords and cables provides an extra measure of employee safety.

&

A new process removes helium from natural gas, in which it is a contaminant, by passing the gas through glass pipes, through the walls of which the helium is filtered.

&

An atomic-powered train has been designed that will travel across country without tracks. It has fifty-two wheels, each of which is electrically driven.

&

The plastic base of a new electric coffee pot completely encloses and waterproofs both heating element and thermostat.

&

Titanium alloyed with ranadium, chromium and aluminum makes a new alloy that is said to have the greatest strength for its weight of any structural material.

&

A complete picture, ready for transmission, is provided by a new transistorized television camera. It weighs only four pounds, including self-contained control and synchronizing units.

&

A radio telescope over four-hundred feet in diameter is planned for the hills of West Virginia.

&

Weather information can be transmitted over a thousand-mile range by an automatic radio station which can be dropped anywhere by an airplane.

&

An automatic electronic inspection machine makes a four-way check of automobile valves at the rate of 3,000 per hour with a tolerance of five millionths of an inch.

An adhesive has been developed that will retain a metal-to-metal bond at temperatures as low as −253 degrees C.

&

All cords and cables give better service when handled properly. TIREX® portable cords and cables, *although jacketed with fortified and tempered neoprene armor and "lead cured" for toughness and smoothness*, will give still longer service if not subjected to unreasonable abuse.

&

By making jet nozzles radioactive and measuring the radiation from the fuel passing through them, the amount of wear can be measured to within one millionth of a gram per hour.

&

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

&

A miniature battery which is reported to last for five years, uses the radioisotope Prometheum 147. It is suitable for hearing aids, watches or missile guidance systems.

&

In California, it is proposed to use underground steam to generate electricity as is being done in Italy and New Zealand. Wells are now being drilled and a yield of 100,000 kilowatts is anticipated.

&

Two radio manufacturers have built extra service into their sets. One warns of approaching tornadoes and the other acts as a radiation detector.

&

Deuterium, or heavy hydrogen, is concentrated by some bacteria from sea water. This discovery may lead to a new and inexpensive method of producing the heavy water used in reactors.

The area behind the eye that can not be examined by other instruments can now be seen by a device that uses penetrating sound waves and converts their reflection into light.

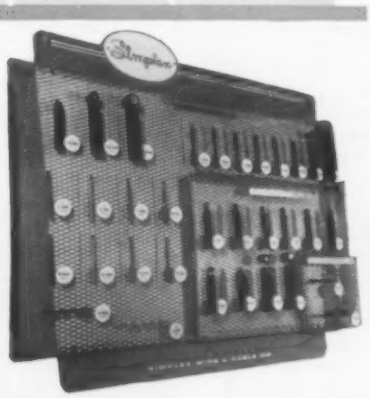
&

A disposable medicine container of heat-proof plastic doubles as a hypodermic syringe.

&

Our atmosphere at an altitude of sixty miles is now known to contain chemicals which could serve as an unlimited fuel supply for ramjet engines.

Visit Booth 162, 4th National Electrical Exposition, Dallas, Nov. 18-20



What's in a name?

The character and business integrity of distributors are measured to a great extent by the products they handle. More than 1000 of the nation's most successful electrical firms — offering the utmost in customer service and satisfaction — recommend and sell Simplex TIREX cords and cables.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling

MOTOR INSTALLATION - MOUNTING AND CONNECTING
220 VOLT AT 10 FT. HT.

MOTOR SIZE	HOURS EACH	LABOR COST INSTALLED EACH AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
1	6.9	8.63	10.35	12.08	13.80	15.53	17.25	18.98	20.70	22.43	24.15	25.88
2	6.9	8.63	10.35	12.08	13.80	15.53	17.25	18.98	20.70	22.43	24.15	25.88
3	6.9	8.63	10.35	12.08	13.80	15.53	17.25	18.98	20.70	22.43	24.15	25.88
5	11.0	13.75	16.50	19.25	22.00	24.75	27.50	30.25	33.00	35.75	38.50	41.25
7 1/2	13.9	17.38	20.85	24.33	27.80	31.28	34.75	38.23	41.70	45.18	48.65	52.13
10	17.9	22.38	26.85	31.33	35.80	40.28	44.75	49.23	53.70	58.18	62.65	67.13
15	22.1	27.63	33.15	38.68	44.20	49.73	55.25	60.78	66.30	71.83	77.35	82.88
20	27.0	33.75	40.50	47.25	54.00	60.75	67.50	74.25	81.00	87.75	94.50	101.25
25	32.6	40.75	48.90	57.05	65.20	73.35	81.50	89.65	97.80	105.95	114.10	122.25
30	38.5	48.13	57.75	67.38	77.00	86.63	96.25	105.88	115.50	125.13	134.75	144.38
40	46.5	58.13	69.75	81.38	93.00	104.63	116.25	127.88	139.50	151.13	162.75	174.38
50	57.9	72.38	86.85	101.33	115.80	130.28	144.75	159.23	173.70	188.18	202.65	217.13

E-101-B

LABOR: INCLUDES PREPARATION TIME, HANDLING MOTOR AT SITE, SETTING TO POSITION, SECURING IN PLACE AND CONNECTING TAPS.

11-58

MOTOR INSTALLATION - MOUNTING & CONNECTING
440 VOLT INSTALLED ON FLOOR

MOTOR SIZE	HOURS EA.	LABOR COST INSTALLED EACH AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
1	4.7	5.88	7.05	8.23	9.40	10.58	11.75	12.93	14.10	15.28	16.45	17.63
2	5.5	6.88	8.25	9.63	11.00	12.38	13.75	15.13	16.50	17.88	19.25	20.63
3	6.4	8.00	9.60	11.20	12.80	14.40	16.00	17.60	19.20	20.80	22.40	24.00
5	7.6	9.50	11.40	13.30	15.20	17.10	19.00	20.90	22.80	24.70	26.60	28.50
7½	9.5	11.88	14.25	16.63	19.00	21.38	23.75	26.13	28.50	30.88	33.25	35.63
10	12.2	15.25	18.30	21.35	24.40	27.45	30.50	33.55	36.60	39.65	42.70	45.75
15	15.1	18.88	22.65	26.43	30.20	33.98	37.75	41.53	45.30	49.08	52.85	56.63
20	18.3	22.88	27.45	32.03	36.60	41.18	45.75	50.33	54.90	59.48	64.05	68.63
25	22.0	27.50	33.00	38.50	44.00	49.50	55.00	60.50	66.00	71.50	77.00	82.50
30	26.1	32.63	39.15	45.68	52.20	58.73	65.25	71.78	78.30	84.83	91.35	97.88
40	31.4	39.25	47.10	54.95	62.80	70.65	78.50	86.35	94.20	102.05	109.90	117.75
50	38.8	48.50	58.20	67.90	77.60	87.30	97.00	106.70	116.40	126.10	135.80	145.50
60	48.4	60.50	72.60	84.70	96.80	108.90	121.00	133.10	145.20	157.30	169.40	181.50
75	60.4	75.50	90.60	105.70	120.80	135.90	151.00	166.10	181.20	196.30	211.40	226.50
100	82.5	103.13	123.75	144.38	165.00	185.63	206.25	226.88	247.50	268.13	288.75	309.38
125	89.8	112.25	134.70	157.15	179.60	202.05	224.50	246.95	269.40	291.85	314.30	336.75
150	99.0	123.75	148.50	173.25	198.00	222.75	247.50	272.25	297.00	321.75	346.50	371.25
200	111.0	138.75	166.50	194.25	222.00	249.75	277.50	305.25	333.00	360.75	388.50	416.25

E-101-B

LABOR: INCLUDES PREPARATION TIME, HANDLING MOTOR AT SITE, SETTING TO POSITION, SECURING IN PLACE AND CONNECTING TAPS.

11-58

Electrical Estimating—III

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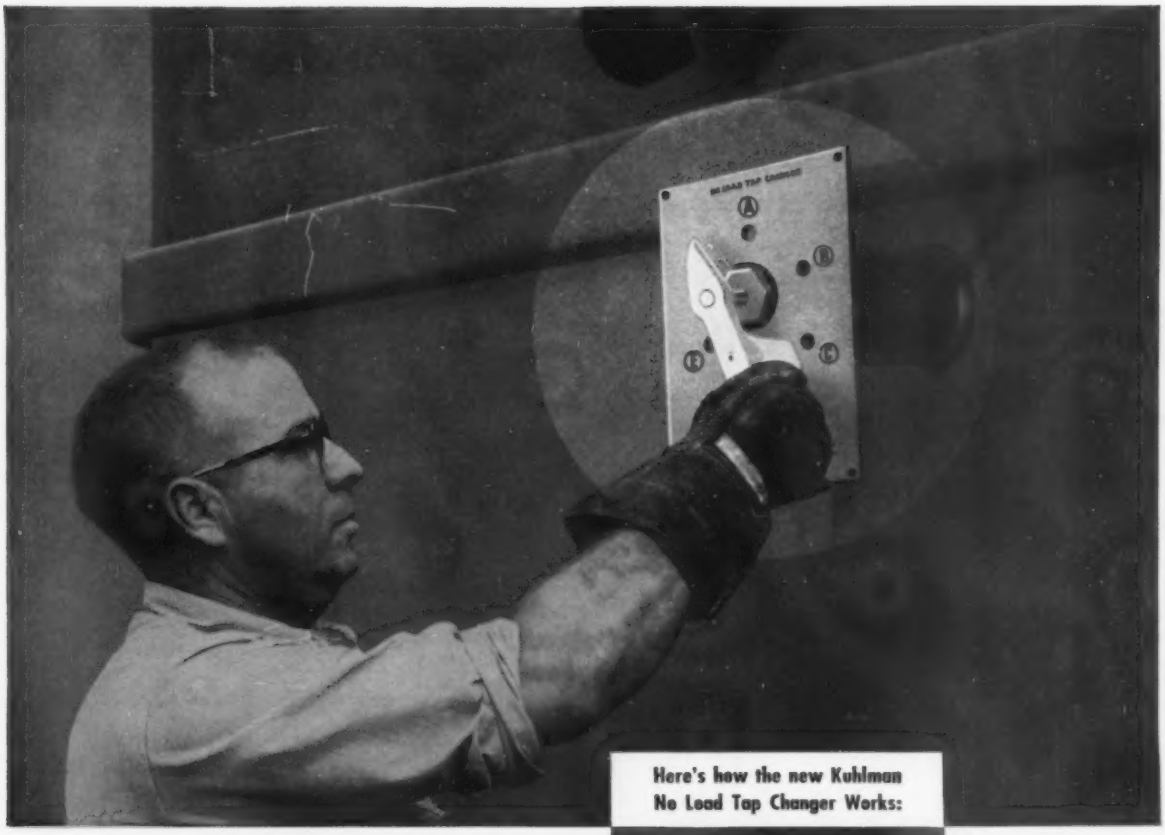


NEW!

NO LOAD TAP CHANGER* WITH *"FREE-ACTING"* ROTOR FOR AUTOMATIC, TRUE ALIGNMENT

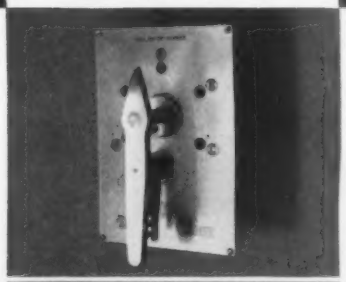
The new "self-aligning" tap changer now standard on all Kuhlman Substation Transformers puts an end to inefficient tap connections caused by misalignment.

The rotor contacts of the new tap changer function as a "free-acting" crosspin universal joint which eliminates the problem of misalignment between the rotor and stationary contacts. This "free-action" assures positive contact, true alignment always, and obsoletes the commonly used "flat surface" contacts which, by their construction, are subject to the faults of misalignment.

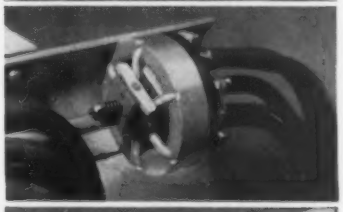
The new tap changer also features a new pistol-grip handle which locks in position and a quick-disconnect mechanism for simple, manual disengagement of the tap changer without the use of tools when untanking the core and coil assembly.

*patent applied for

Here's how the new Kuhlman No Load Tap Changer Works:



The pistol-grip trigger release allows the handle to be moved to the desired tap position. The trigger plunger then snaps solidly into position where it can be padlocked if desired.



The "free-acting" rotor contacts, functioning as a crosspin universal joint, eliminate the problem of misalignment between the rotor and stationary contacts.

Tap changer can be disconnected for removing the core and coil assembly by a tongue and groove mechanism located inside the tank.

Get all the advanced features offered with Kuhlman Substation Transformers. Write today for our new bulletin CS-701.

KUHLMAN POWER TRANSFORMERS

KUHLMAN ELECTRIC COMPANY General Offices: Birmingham, Michigan • Southern Division: CRYSTAL SPRINGS, MISSISSIPPI

Contractors tell how

Trailer provides job office, warehouse, and advertising

By Elmer French
Whelchel Electric, Inc.
Sarasota, Fla.

◆ ONE OF THE BEST investments we have ever made is the purchase of two used trailers, 30 feet long, for use as a warehouse and office at the site of a lengthy job. We figure that having these units painted and dolled up like new, makes both a rolling and fixed billboard which gives us at least a thousand dollars' worth of advertising from each.

They have proved so useful that we have contemplated the purchase of several more. The vans cost us about $2,000 fully equipped, and we pay from $1 to $15 to have a tractor pull them from one job site to another.

We try to park the units close to the nearest main highway at the job, so that passing traffic may see our name and see that Whelchel Electric is doing the job.

The vans lend far more prestige to us than the common run of work shanties seen on jobs, and they thus further the impression that we are an up-and-coming outfit. The interior spaciousness of these bodies makes them easy to move around in and find needed materials, and this helps keep high-priced labor on the ball.

Like an expensive but most useful labor-saving machine, these trailers certainly pay their way, and their sturdy construction makes them far more burglar-proof than makeshift and dilapidated lean-to shacks.

No business can grow and prosper unless it stays modern, and these trailers are certainly a significant step in that direction. Investment in them is well-justified by reason of the economy they have made possible. Inventory of materials on the job is easier, and when we set one up at a job site, we have automatically set up a large billboard that will advertise us during the entire job.

Headquarters for Whelchel Electric on long-term jobs are these mammoth vans which serve as job office, warehouse, and advertising billboard. Steel steps provide a walk-up ramp for easy access to the interior.

Public relations aided by modern products, methods

By Hulett Smith
Hulett Smith Electric & Heating Co.
Tuscaloosa, Ala.

◆ PROGRESS is just as important to the electrical contractor as it is to any other business man. At our shop we believe in growing and developing with our city. This means keeping abreast of the

times with new equipment and new methods. In fact, this has been a major public relations move for our shop. Around the shop we simply say there are two things we must have—credit and friends. Keeping abreast of the times helps build both, and with good management, it builds profit too.

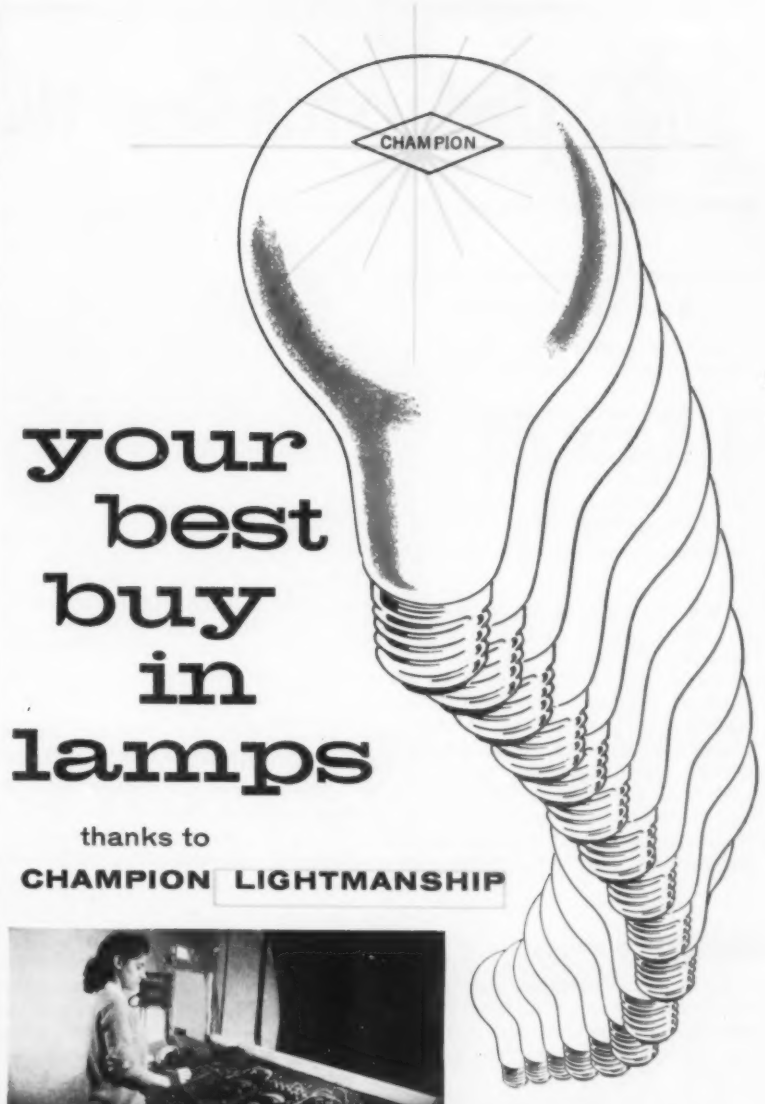
Shortly after low-voltage remote control wiring was available we began to introduce it in our territory and have been using it ever since, keeping abreast of new ideas introduced in this particular field. Through working with the low-voltage wiring we have cemented friendships with builders, architects, and homeowners. This has helped secure many wiring jobs for us.

We followed the trend to central heating and air conditioning. Equipment was selected to fit the needs of our city and to enable us to compete effectively. Instead of figuring on wiring alone we figure air conditioning and heating, also.

Currently we are going into sales of window or room type heat pumps. They are being introduced to our trade through an exhibit booth at the county fair, another first for us in way of promotion and public relations. Through this new product we expect to win more friends and offset the market drop in room air conditioners.

In order to maintain our wiring standards we bid only on the better-type residence work, where top grade materials are used and installation is done as it should be done.

We carry on maintenance and service work for two reasons. First, it keeps the friendships and the contacts that bring other work our way. The second reason is that if new construction falls off we have something to fall back on. For these reasons we consider it good business to carry on maintenance and service work even though we only break even on such jobs. My two sons, Haynes S. and Hulett M., Jr., are associated with me. Both are graduate engineers. Haynes handles the air conditioning and heating, and Hulett the wiring. We consider ours only a small contracting business. The fact that we did a gross business of $250,000 last year is due a great deal to keeping abreast of the times with new equipment and new developments in electrical contracting.



your best buy in lamps

thanks to

CHAMPION LIGHTMANSHIP

MILLIONS OF LAMPS A YEAR . . .
ONE PLANT standard of quality control

TEST . . . TEST . . . TEST . . . Continuous testing is one of the many ways Champion applies LIGHT-manship to make sure that every Champion Lamp is uniform in life and light output . . . that you don't have to worry about early burn-outs and early dim-outs when you use Champion lamps.

Send for the New MAINTENANCE MANUAL. 48 pages of practical suggestions for making the most of your lighting system.

CHAMPION LAMP WORKS
Lynn, Massachusetts
A division of Consolidated Electric Lamp Co.

CHAMPION Lamps
Incandescent Fluorescent
Your best buy in lamps

Understanding the Code

By Walter R. Stone

This article should be especially helpful to the following readers:

Electrical Contractors ✔
Electric Utilities ✔
Electrical Wholesalers ✔
Electrical Inspectors ✔
Industrial Engineers ✔
Consulting Engineers ✔

◆ WE CONTINUE in this issue with our discussion of overcurrent protection. Section 2404 cautions against the erroneous use of thermal devices for protection against overcurrent due to short-circuits or grounds. These devices, which are approved only for overload protection for motors and motor branch circuits, are not to be confused with the thermally controlled circuit-breakers referred to in the fine print note following section 2403-c.

The thermal device referred to in section 2404 is the type usually found in magnetic starters and, for small motors, in the toggle switches with the motor overload "heaters." The heaters, of course, are the thermal devices which cause the bi-metallic contacts to open. Thermal devices are also "built-in" some motors to provide the well-known integral motor overcurrent protection against overloads. In all cases where such thermal devices are used for overload protection, additional protection must be provided for overcurrents due to shorts and grounds.

Thermally-controlled breakers

The thermally-controlled circuit-breaker referred to in the fine print note following section 2403-c is one of a group of circuit-breakers which, together with fuses, is approved for this required protection against overcurrents due to shorts and grounds. Like other types of circuit-breakers, it can serve also as protection against motor overloads, provided that it is rated at not more than 125% of the motor full-load current for motors marked to have a 40C temperature rise and rated at not more than 115% of the full-load current of other types of motors.

This type of breaker is responsive to extreme ambient temperatures and therefore this factor must be considered when using a thermally-controlled circuit-breaker. For instance, if the load to be protected is in a location having a cool or "normal" temperature and the breaker is installed in an extremely hot location, occasional nuisance tripping could result.

Code test questions

1. Thermal cutouts and other devices not designed to open short-circuits shall be used only for protection against overcurrent due to grounds. True or false?

2. Thermal relays and other devices not designed to open circuits in the event of ground fault currents may be used to protect circuits from overcurrents due to short-circuits. True or false?

3. Thermal devices not designed to open short-circuits may be used to protect motor branch circuit conductors from overload. True or false?

4. Each conductor of a constant-potential circuit entering a supply station, including the neutral conductor, shall be protected from excessive current by a circuit-breaker. True or false?

5. Each conductor of a constant-potential circuit leaving a supply station, except grounded neutral conductors, shall be protected from excessive current by a circuit-breaker or an equivalent device. True or false?

6. Overcurrent protective devices placed in constant-potential conductors entering or leaving a supply station shall be located:

(a) as far as possible from where the conductors enter or leave the building.

(b) as near as practicable to the point where the conductors enter or leave the building.

(c) in the lightning arrester circuit.

Which is correct: a? b? c?

7. On circuits leaving a supply station and not connected with any other sources of power, the protective devices may be:

(a) omitted.

(b) increased by an amount not exceeding 250%.

(c) placed on the supply side of the transformers.

Which is correct: a? b? c?

8. Where the ungrounded conductors are reduced in size, a similar reduction in the grounded conductor may also be made:

(a) with no further provisions made for the grounded conductor.

(b) provided that the grounded conductor is provided with overcurrent protection at the point where its size is reduced.

(a) provided that the overcurrent protection in the larger conductor does not have a higher rating than the smaller ungrounded conductor.

Which is correct: a? b? c?

9. Fuses in multiple may be used to protect an 800-ampere circuit provided that:

(a) not more than two such fuses are used in each phase.

(b) not more than four such fuses are used in each phase.

(c) such fuses are of the time delay type.

Which is correct: a? b? c?

10. Fuses of the following type are permitted to be connected in multiple:

(a) cartridge type only.

(b) Edison base type only.

(c) either type provided that they are terminated in a manner that will eliminate any potential difference between them.

Which is correct: a? b? c?

Answers will be found on page 103.

TYPE M STRAND

the price is RIGHT!

If someone asked you the price of Copperweld Strand, the chances are that you'd err on the high side. Why?

Simply because this permanently non-rusting guy and messenger strand has for more than 40 years been rated absolute tops in its field. Judged by the admittedly longer service and maintenance-free life its use assures, you'd naturally expect it to cost more—much more. But that's no longer true.

Now, with the new Type M Strand, you can obtain all the money-saving and performance advantages of Copperweld construction at a price comparable to that of ordinary strand. This was made possible by developing new higher strengths especially suited for guy and messenger use, and introducing new cost-cutting production techniques.

Pliable and easy to handle, this superior strand is available in a complete range of breaking strengths. Ask us to quote on your guy and messenger requirements. You'll find the price is right.

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION *Glassport, Pa.*
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Furnished in coils of 250, 500 and 1,000 feet depending on the size. Reels of 2,500, 5,000 and 10,000 feet are also available.

Copperweld®

TYPE M™

GUY and MESSENGER STRAND

If the opposite is true, however, and the load is in a location having above normal temperatures and the breaker is installed in an extremely cold location, the insulation of the circuit conductors could become damaged by excessive temperatures resulting from the combined ambient temperature plus the heat from possible overload currents before the breaker would operate.

In such extreme cases, a breaker which responds to current flow only, such as a magnetic-trip type, or one combining the use of magnetic-trip with thermal-trip action, would be a better choice than the breaker which depends solely on thermal action for tripping.

Of course, where both the breaker and the connected load are in the same location and both are subjected to the same temperatures, the thermal action type is self-compensating to a certain degree, in that it will trip on a smaller load current in high ambient temperatures than in low, thereby automatically derating the current-carrying capacities of the conductors where this protection is most needed and increasing such capacities where no harm would result. Ambient temperatures have only a negligible effect on such breakers, however, unless they are extremely high or extremely low temperatures.

Special treatment will be devoted to the detailed requirements of motor overcurrent protection when we discuss motors in general in a later issue.

An overcurrent device, which may be either a fuse or a circuit-breaker, is required to be placed in each ungrounded conductor. If a circuit-breaker is used, however, it is required to open all ungrounded conductors of the circuit which it protects. A fuse, on the other hand, is required to open only the conductor which has excessive current as a result of an overload, a short, or a ground. Individual single-pole circuit-breakers are permitted, however, on certain types of circuits, in which case the action would be similar to that permitted for fuses. That is, in the use of single-pole breakers, only the breaker in the conductor with the excessive current would open, leaving the breaker or breakers intact which were connected in the other ungrounded conductor or conductors of the circuit.

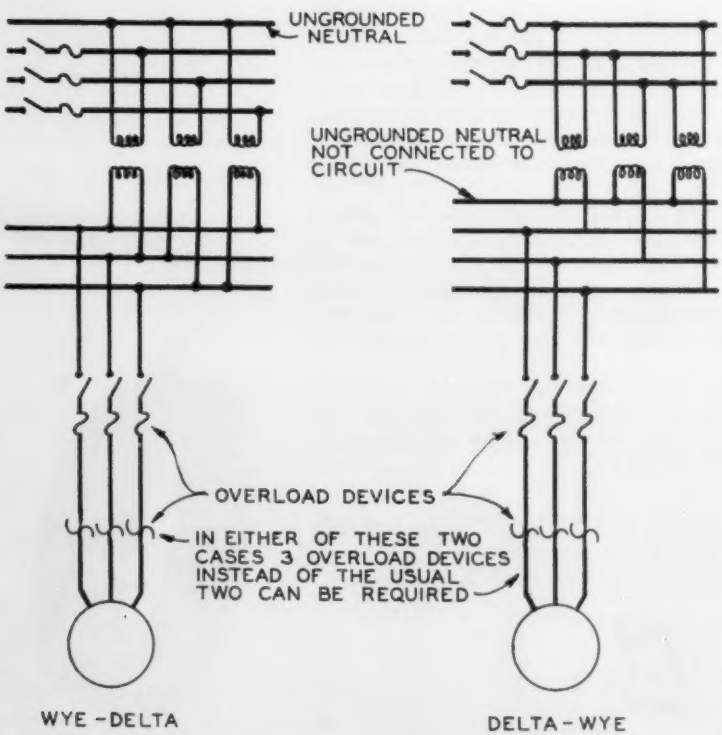

UNGROUNDED NEUTRAL
UNGROUNDED NEUTRAL NOT CONNECTED TO CIRCUIT
OVERLOAD DEVICES
IN EITHER OF THESE TWO CASES 3 OVERLOAD DEVICES INSTEAD OF THE USUAL TWO CAN BE REQUIRED
WYE - DELTA
DELTA - WYE

Fig. 1—In either of the cases shown here, a blown fuse in one phase of the primary will result in the current in the motor conductors exceeding normal balanced full load by 115% in each of two phases and by 230% in the other phase. If only two overcurrent devices were used, the phase having 230% normal current could be the one without protection. A special note in Section 4327 gives the Code enforcing authority right to require three overload devices instead of the usual two in such cases.

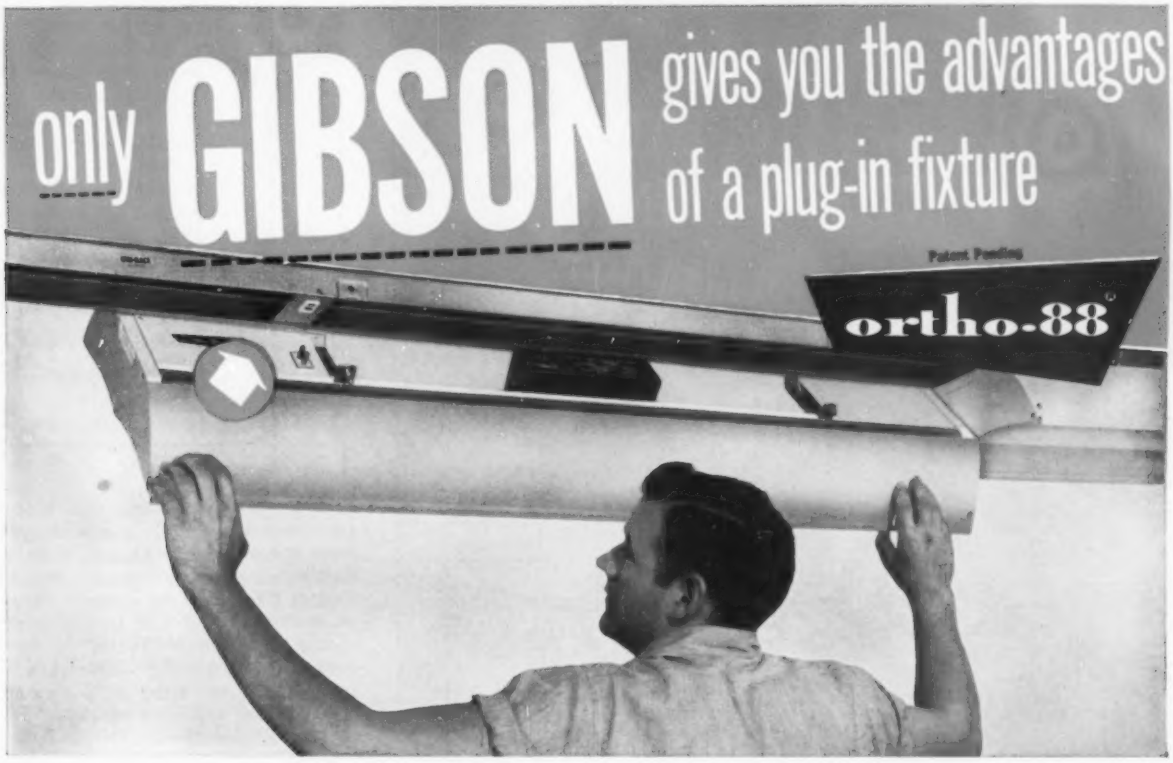
Single-pole breakers

The type circuits in which such single-pole breakers are permitted to be used and the minimum number permitted in each type circuit is as follows: (1) Ungrounded 2-wire circuits: two required, one in each conductor. (2) 3-wire d-c or 3-wire a-c single-phase: one required in each ungrounded conductor. (3) Lighting and appliance branch circuits which are connected to 4-wire three-phase or 5-wire two-phase systems: one required in each ungrounded conductor. These lighting and appliance branch circuits listed under type (3) must be derived from a system having a grounded neutral with the voltage limited to that permitted for such branch circuits, such as 150 volts to ground for general lighting circuits and 300 volts to ground on lighting circuits permitted to be supplied by 480/277 (460/265) volt systems.

Single-pole breakers are not permitted to be used on 3-phase circuits. They are permitted to be used for single-phase circuits derived from 3-phase grounded systems, including multi-wire circuits having three ungrounded phases of opposite polarity and a common neutral. But they are not permitted to be used for 3-phase circuits. This restriction includes 3-phase circuits having one phase grounded. The grounded phase must be identified and treated as an identified conductor. The two remaining ungrounded conductors, however, must be protected either by fuses or by a circuit-breaker which will open both ungrounded conductors—not by two single-pole breakers.

Table 28 of the Code lists the minimum number of overcurrent devices required as well as listing the conductors in which each is required to be placed. Diagrams 1 through 19 show these graphically. Table 28 refers to another table in section 4327 for motor running overcurrent devices. Both of these tables are followed by notes which are sometimes misunderstood. We will discuss these notes briefly. Although the table in section 4327 rightfully belongs in a discussion

only GIBSON gives you the advantages of a plug-in fixture



Incomparable Flexibility • Ortho fixtures can be mounted in continuous rows or at intervals. Can be re-spaced any time by one man without tools.

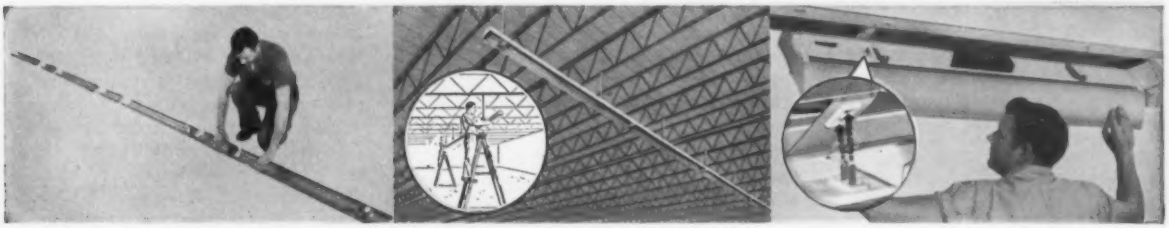
Ease of Maintenance • Ortho fixtures can be removed for cleaning or repairs without cutting off other fixtures in row.

Low-Cost Installation • Ortho fixtures can be installed in a mere fraction of the time it takes to install conventional fixtures. Contractors report up to 75 percent savings in labor.

Made for All Standard and High Output Lamps

The Ortho 88 is made in 48" and 96" lengths for the following lamps: Rapid Start; Slimline; 800 ma R. S.; Power Groove; VHO and SHO. All fixtures, except the 40 w. Rapid Start with all other fixtures of the same length.

installation quick and simple



1 Uni-Race, U.L. approved raceway of 225-amp capacity, is assembled and wired on floor.

2 Light, rigid Uni-Race assembly up to 48' easily lifted and hung.

3 Fixtures simply snap into place. Plug-in fixture engages receptacle in Uni-Race.

WRITE FOR COMPLETE INFORMATION ABOUT THE GIBSON ORTHO PLUG-IN FIXTURES

GIBSON MANUFACTURING COMPANY

1919 PIEDMONT CIRCLE, N. E. ATLANTA 9, GEORGIA

Manufactured in Canada under franchise by Electrolier Manufacturing Co., Ltd., Montreal

Ask your Westinghouse representative
about the exclusive benefits you get from

URL AND URF REGULATORS... "LIKE NEW" PERFORMANCE FOR TOMORROW'S LOADS

In Westinghouse URL and URF regulators, carbon accumulation *cannot* clog cooling ducts. Changing taps under load in a regulator requires interrupting an arc under oil and this arcing causes the release of free carbon. If not restrained, this accumulation *can* clog cooling ducts, reducing cooling efficiency and stealing load-carrying ability. Under heavier loads more carbon is released and in time overheating may become a problem.

A separate tap changer compartment in each URL and URF regulator keeps carbon out of the main tank oil. This prevents carbon build-up in the cooling ducts . . . cooling efficiency and load-carrying ability remain high.

In feeder voltage regulators, only Westinghouse URL and URF regulators offer a separate tap changer compartment — at no extra charge. Here is your assurance that the full value of *like-new* performance will still be yours — even ten or twenty years from now.

See your Westinghouse representative for the full story of better regulation — from URL and URF regulators — made possible through PLOWBACK OF EARNINGS into research for the solution of the electric utility industry's immediate and long-range problems. J-70895

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS," CBS TV MONDAYS

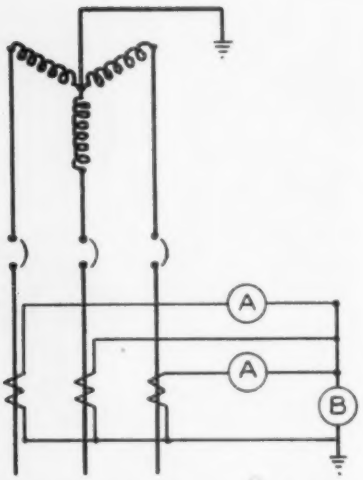


Fig. 2—While the general Code rule requires for three-phase systems three series trips, one in each ungrounded conductor, an exception is provided for certain cases where three current transformer secondaries are connected to two overcurrent tripping devices and a residual current tripping device as shown here. OC trips marked "A" operate on overload; residual device "B" operates on ground fault.

on motors, which will appear in a later issue of this magazine, the note following this table will be discussed now along with the notes following table 28.

Special requirements

The note following the table in section 4327 gives the inspector authority to require three instead of the usual two motor overload protective devices in 3-phase motor circuits when supplied by either a wye-delta or by a delta-wye distribution system when such system does not have the neutral point of the wye grounded or connected to the system unless otherwise adequately protected. Where the primary is protected by circuit-breakers which open all of the phases simultaneously, this is considered as sufficient by some inspectors to satisfy the additional protection required by the note against single-phasing of the motors.

Unless some loss-of-phase protection is provided, however, on such installations, a fault opening only one phase of a primary will cause current to flow in the secondary in excess of the normal current which flows when the system is balanced. The magnitude of

this current in the secondary will be 115% of normal in two of the phases and 230% of normal in the other phase. If the phase which carries the 230% has no overcurrent protective device, the two devices in the other two phases would have to function on a 115% overload. This functioning would be most unlikely under these con-

(Continued on page 102)

Questions on the Code

(Readers are invited to send in questions which they would like to see discussed in this department. Address them to Code Editor, ELECTRICAL SOUTH, 806 Peachtree St., NE, Atlanta 8, Ga.)

Size of neutral serving ballasts

QUESTION: The last sentence of section 2303-g states, "In a feeder where the load consists of 50% or more of electric discharge lamp ballasts, there shall be no reduction in size of the neutral conductor below the size of the phase conductors." Would you please explain why no reduction is permitted in this case even when the load is balanced between each such phase and the neutral? And how did this rule get in the Code?

ANSWER: The reason for the Code requirement, which appeared for the first time in the 1956 issue of the Code, is the presence of neutral currents approximately equal in value to the phase currents when the load consists of fluorescent ballasts.

The neutral currents, in this case, result from the effects of the third harmonic. There are other harmonics present, also, but only the third is of any consequence. Whereas the normal 60-cycle currents amount to an algebraic sum of approximately zero in the neutral, the 180-cycle currents are approximately equal to the arithmetic sum of the individual crests of the separate 60-cycle currents, the total of which nearly equals in magnitude the normal currents in each phase. Hence, the neutral must be of equal size even though the phase loads are balanced.

The best study of this third harmonic effect with which I am familiar was made by Don B. Berry, of the Texas Electric Service Company, Fort Worth, Texas. Mr. Berry presented a paper as a result of his study to the North Central Division of the Texas Chapter of the International Association of Electrical Inspectors at the May 3, 1957, meeting of this body. This paper was later published in the July, 1957, issue of the IAEI *News Bulletin*, the official publication of the Inspectors Association.

Prior to this, the *News Bulletin* published in the May, 1955, issue an article on this subject by B. A. MacDonald who is associate editor of the *News Bulletin* and retired Chief Inspector of the New York Board of Fire Underwriters. In this article, Mr. MacDonald describes how the Chairman of Code Panel No. 2, H. H. Watson, of the General Electric Company, and Merwin Brandon, vice-president of the Underwriters Laboratories, Inc., and chairman of the Code Correlating Committee, together with other interested parties, discovered the need for and, hence, supplied this addition to the Code.

Trip-free breaker operation explained

QUESTION: What is meant by section 2389-d where it says that trip-free breakers are to be used so that the circuit-breaker is free to open in case it is closed on an overload? I thought trip-free meant that it would *open* on an overload even if the handle was held closed. But I thought that it first had to be closed before any action could take place. How does it protect the operator against closing on a heavy overload, such as a short-circuit, during the instant of closing?

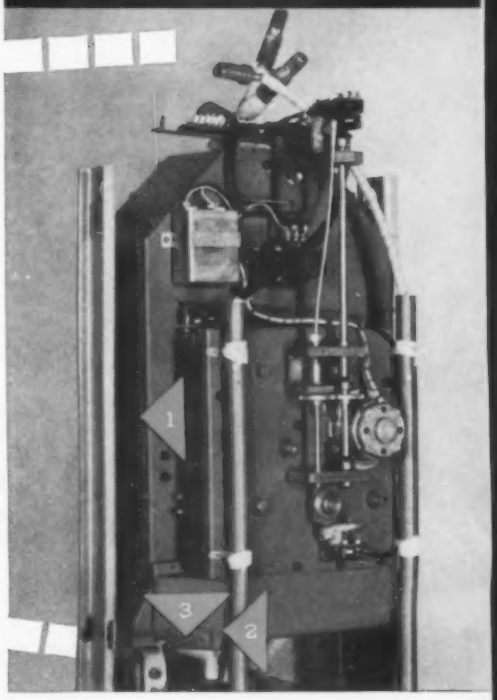
ANSWER: It is true, as you say, that a trip-free breaker cannot be held in the closed position on an overload. But neither can the kind of breaker referred to in this section of the Code be closed against an overload of dangerous magnitude. This is one of the sterling quality features of this type of breaker.

The breaker will close only to that position where the arcing contacts meet, at which point the abnormal current of the overload flows through the trip coil. The trip disengages the closing mechanism from the contact mechanism, preventing the main contacts from being latched closed. This rapid automatic action prevents damage to the breaker main contacts, relieves the circuit of dangerously heavy currents, and protects the operator from the tragic closing of a circuit under short-circuit conditions.

Exclusive separate

tap changer compartment

GUARDS SYSTEM LOAD CAPABILITY



The separate tap changer compartment built into your Westinghouse URL or URF regulator is your assurance of peak operating efficiency — now, and *for future loads.* Here are the three basic construction features that provide constant service reliability with minimum maintenance:

1. Felt gasketing keeps carbon out of the main tank and permits equalization of the oil level at all times.
2. Sump collects sediment which is easily, quickly drawn off.
3. Separate external drain facilitates renewal of oil in tap changer compartment.

Only Westinghouse URL and URF regulators (available in sizes 250 kva or below) offer all these bonus values of the separate tap changer compartment for distribution-type regulators. J-70896

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

News of the industry

edited for Southern readers

Grauer named president Southern Section, IAEI

C. B. Grauer, of the Mississippi State Rating Bureau, Jackson, has been named president of the Southern Section, IAEI. Serving with

C. B. Grauer

him in the ensuing year will be C. R. Kennedy, 1st vice-pres.; A. M. Totty, 2nd vice-pres.; A. M. Miller, secretary; and R. E. Ward, assistant secretary.

AIEE in Kansas City to present lectures

THE KANSAS CITY SECTION of AIEE this fall is presenting a series of four popular lectures on the Science of Electricity. This is a public service in keeping with today's high interest in science. The lectures will be for the layman, the student, and the science teacher. They will be entirely separate from regular business and technical meetings. The subjects of the lectures will be An Introduction to the Science of Electricity, Communications, Electronics, and Power.

S. H. Pollock, of Kansas City Power and Light Co., is chairman.

EMRA elects Clements president for 1959

GEORGE CLEMENTS has been elected president of the Electrical Manufacturers Representatives Association of Baltimore, Maryland, succeeding Bill Chenoweth. Other officers elected include Vernon Letmate, vice-president; Richard Dunlop, secretary; and Joseph Scholl, treasurer.

An important 1959 activity of EMRA will be the Electrical Trade Conference and Exposition which it sponsors annually in cooperation with the Electric Institute of Washington.

General chairman of the EMRA Conference Committee is H. L. Robinson. The Exhibit Committee is headed by R. V. Gordon and P. O. West; Conference Committee by M. C. Nelson and H. V. Oerting; and Attendance Committee by J. V. Letmate and F. B. Crider.

Federal Pacific elects Cole new president

THOMAS M. COLE has been elected president of Federal Pacific Electric Company, succeeding Joseph S. Thompson, who has been named honorary chairman.

Mr. Cole has been executive vice-president of Federal Pacific since its formation as a result of a merger between Federal Electric Products Co. of Newark, N. J., and Pacific Electric Manufacturing Corp., San Francisco, Calif., in 1954. Mr. Thompson, who was president of Pacific Electric, became president of the new company.

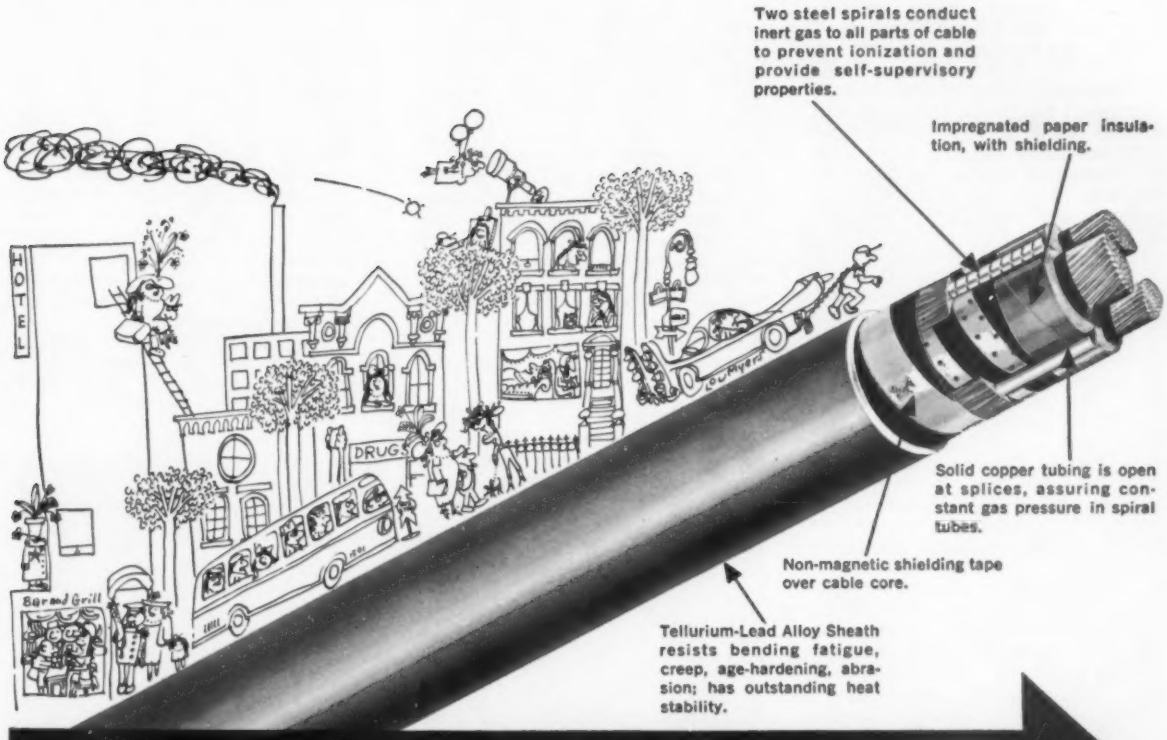
Federal Pacific has expanded in

Thomas M. Cole

the electrical manufacturing field at a record rate. When Cole took over management of Federal Electric Products Co. in 1941, the concern was producing only a limited line of low-voltage equipment, employed 25 people, and had total sales of under $1 million annually.

Today, company sales are running at an annual rate of over $60

NEW PUAA OFFICERS—Samuel E. Weimer, newly elected Region 5 chairman of the Public Utilities Advertising Association, and the advertising director of South Carolina Gas and Electric Co., receives the gavel from Warren Bateman, outgoing chairman and assistant manager, public relations department, Georgia Power Co. Left to right are Bateman; Virgil S. Price, Region 5 vice chairman; George W. Kindon, PUAA president; Weimer; and Frank C. Lietz, second vice president, PUAA.


Two steel spirals conduct inert gas to all parts of cable to prevent ionization and provide self-supervisory properties.
Impregnated paper insulation, with shielding.
Solid copper tubing is open at splices, assuring constant gas pressure in spiral tubes.
Non-magnetic shielding tape over cable core.
Tellurium-Lead Alloy Sheath resists bending fatigue, creep, age-hardening, abrasion; has outstanding heat stability.
HOTEL
DRUG
Bar and Grill

KEEPS UPHILL POWER "ON THE LEVEL"!

ROEBLING
GAS-FILLED CABLE

What happens when solid-type cable is used on steep grades? If you've used it, you know! The oil impregnant simply obeys the law of gravity and drains to the bottom of the grade. At the low point, hoop stress (caused by oil pressure build-up) makes the lead sheath stretch. Eventually a rupture occurs. And in the areas drained of oil, ionization takes place.

What's the answer to this constant (and inevitable) problem? *Roebling Low-Pressure Gas-Filled Cable*—for voltages up to 46 kv! Dry nitrogen gas, inside this cable at approximately 12 psi pressure, provides consistent dielectric properties throughout the length of the cable. No matter how steep the grade, internal pressure is uniform everywhere.

Another feature of this cable is that it is self-supervisory—an alarm system lets you know if there's trouble along the line.

Roebling Low-Pressure Gas-Filled Cable is as easy to splice as solid-type paper power cable. It offers the least expensive long-term answer to the problem of transmitting power uphill! Get the whole story from your Roebling Field Representative soon. Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities • Subsidiary of The Colorado Fuel and Iron Corporation

million. With 16 plants and more than 80 sales offices located throughout the United States and Canada, the company employs approximately 4,000 people and manufactures a complete line of equipment for the distribution and control of electricity—more than 1,500 products, ranging from simple household circuit breakers to complex switchgear for giant industrial and electric utility installations.

Federal Pacific Electric Company traces its corporate beginnings to Cole Metal Products Co., founded in New York in 1918 by Louis W. Cole, present board chairman. A regional operation, manufacturing electrical enclosures, this company modestly expanded its product line over the years, and in 1935 acquired Federal Electric Products Co., Newark, N. J., manufacturers of switches and fusible equipment.

Federal's first major expansion was the purchase of the Electrical Division of Colt's Patent Firearms Co. in Hartford, Conn. Among other firms acquired were Wm. Wurdack Manufacturing Co., St. Louis, Mo. (panelboards); Powerlite Switchboard Co., Cleveland, Ohio (switchboards and panelboards); Gardner Electric Manufacturing Co., Emeryville, Calif. (transformers); Penn Electric Co., Irwin, Pa. (panelboards); and Roller-Smith Corp., Bethlehem, Pa. (electrical instruments).

Fort Worth contractor occupies new building

ONE OF THE SOUTHWEST'S long-established electrical contractors, State Electric Co., of Fort Worth, Texas, is now housed in what may be one of the South's best-designed buildings for an electrical contracting business.

State Electric was launched about 1921 by Fred Schmidt and has handled with distinction some of the biggest and most difficult jobs in the territory. For not much less than 30 years the firm was quartered in the same location, in a suburban area of Fort Worth. Several months ago the move of about ten blocks was made to new quarters.

The new plant consists of a lot approximately 300 feet front by 280 feet deep and three principal buildings.

The office building, 50 by 70 feet, is of conventional brick construction, but the pylon planter boxes and entrance walls are of Colorado pink stone. With the exception of the interior reception area, rooms are paneled in fine wood and papered.

Entering the reception room, a visitor notices an attractive planter box arrangement just above floor level and just inside the swinging glass doors. This room is finished entirely in hand-chipped Roman velour pink brick. Here, too, is featured the master station for a two-way inter-communication system that connects with all offices and both warehouses.

Schmidt's office is fully paneled in teakwood while the bookkeeping department, across the reception room, is finished in English oak. A corridor leading from the reception room, splits the building with offices and other rooms on either side. The corridor is of birch finish.

Perhaps the most impressive room in the building is the conference room, finished in walnut, with appropriately-matched furniture. Across from it, the coffee shop is thoroughly domestic in appearance.

The entire building is cooled in summer and heated in winter by means of three, three-ton capacity heat pumps.

Behind the office building a roofed-over space—into which the company can expand if necessary—connects with the nearest of two warehouses. These are each 60 by 120 feet. One is used largely for construction work and fabrication of the company's requirements on its many scattered jobs.

In addition there is a garage area, 20 by 60 feet, where most of the lighter jobs of automotive maintenance are performed.

State Electric Company of Fort Worth, Texas, recently moved into new quarters. The new plant consists of a lot approximately 300 x 280 feet and three principal buildings, including two new warehouses.

Owners and supervisory personnel of State Electric Company. Seated, left to right, are M. T. Harber, Fred Schmidt, and Mrs. Schmidt. Standing are G. H. Thaxton, S. A. Gregory, and H. L. Davis.

L&P Delta Division

INCANDESCENT

Special for November

All the quality, tested performance and economy that have earned Light & Power an enviable reputation in fluorescents are now available in incandescents, through L&P's new Delta Incandescent Division.

For instance, check these features of the Delta Adjustable Recessed Eyeball Unit:

1. Made of heavy gauge aluminum
2. Sphere and face plate in brushed satin, and sprayed with heat-resistant lacquer baked to 375° to assure permanent finish
3. Highly attractive unit for accent or display lighting
4. Ideal for Commercial or Residential applications
5. For use with 150 W/R 40 Flood or Spot

Adjustable *Recessed*
Eyeball Unit
(Smooth, Positive Action)

DELTA

Write today for catalog and price sheets.

Distributed by Wholesale Dealers Only

delta incandescent division **LIGHT & POWER UTILITIES CORP.**
1035 Firestone Blvd.——Memphis, Tenn.

L&P

Elgo Ventilating Specialties

NEW! EXTRUDED ALUMINUM SHUTTERS

With Completely Concealed Pivot Pins

Lightweight . . . Strong . . . Durable

ELGO Shutters Give You All these advantages

- Light Weight
- Full Weather Strip
- Low Freight Cost
- Easier Installation
- Concealed Pivot Pins
- Rust Proof and Corrosion Proof Aluminum
- Natural aluminum finish with fluted frames.

Write for complete specifications

Free CATALOG

ELGO SHUTTER & MFG. CO.
2738 West Warren Detroit 8, Michigan

EXPLOSION-PROOF and WEATHER-PROOF BOXES AND HOUSINGS

in modern light-weight cast-aluminum alloy

Send for Selection and Specification Data, **BULLETIN 158**

THE *Adalet* MANUFACTURING COMPANY
14300 Lorain Avenue, Cleveland 11, Ohio

Dates Ahead

American Institute of Electrical Engineers, Winter General Meeting, Statler Hotel, New York, N. Y., Feb. 1-6, 1959.

Edison Electric Institute, Transmission and Distribution Committee Meeting, Morrison Hotel, Chicago, Ill., Feb. 12-13, 1959.

Southeastern Electric Exchange, Annual Conference, Boca Raton Hotel & Club, Boca Raton, Fla., March 23-25, 1959.

Oklahoma Utilities Association, Annual Convention, Mayo Hotel, Tulsa, Okla., March 26-27, 1959.

American Institute of Electrical Engineers, South East-South Central District Meeting, Dinkler Plaza Hotel, Atlanta, Ga., April 8-10, 1959.

Missouri Valley Electric Association, Engineering Conference, President Hotel & Municipal Auditorium, Kansas City, Mo., April 15-17, 1959.

Southeastern Electric Exchange, Engineering and Operation Section Meeting, Belleview Biltmore Hotel, Belleair, Fla., April 16-17, 1959.

Edison Electric Institute, Meter and Service Committee Meeting, Chase Hotel, St. Louis, Mo., April 27-29, 1959.

Edison Electric Institute, Transmission and Distribution Committee Meeting, The Shoreham, Washington, D. C., May 7-8, 1959.

American Institute of Electrical Engineers, Middle Eastern District Meeting, Lord Baltimore Hotel, Baltimore, Md., May 19-21, 1959.

American Institute of Electrical Engineers, Summer and Pacific General Meeting, Seattle, Wash., June 22-26, 1959.

Edison Electric Institute, Meter and Service Committee Meeting, Wentworth - by - the - Sea, Portsmouth, N. H., Sept. 14-16, 1959.

Public Utilities Association of the Virginias, Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Sept. 17-20, 1959.

Ad mat service provided by copper industry

ELECTRICAL CONTRACTORS selling copper wiring are getting an added sales push these days from an advertising mat service devised especially for them by the copper industry.

Professionally prepared ad mats in one- and two-column sizes with the headline "Modern Living Demands Adequate Copper Wiring" have just been mailed to the publishers of more than 1,500 small daily and weekly newspapers.

The artwork on the mats points up the need today in most homes for additional copper wiring to handle the continuing peak loads of power used to operate television sets, electrical dryers, air conditioners, and other major appliances.

Space has been left on each mat for publication-set copy describing the products available and prices, and for the identifying signature of the local contractor or dealer.

This advertising mat service is part of a continuing program of advertising and sales assistance formulated by the copper industry for all fabricators using this metal and its alloys.

These ad mats may be obtained by writing Copper & Brass Research Association, 420 Lexington Avenue, New York 17, N. Y.

Chance expands crossarm production

F. GANO CHANCE, president and chairman of the board, of the A. B. Chance Company, has announced the purchase of the Chehalis, Washington, crossarm plant of the Joslyn Manufacturing and Supply Co.

This Washington plant will expand the Chance Company's crossarm production facilities which include five American Crossarm and Conduit Company plants acquired in 1957. This company, which has been operated as

1,000TH HEAT PUMP—Recognizing the 1,000th heat pump to be connected to Alabama Power Company distribution lines, sales officials awarded the home owner a special certificate. Left to right, J. Paul Brown, manager residential sales; C. R. Crim, home owner; and C. W. Cheatham, supervisor heating and air conditioning.

ELECTRICAL ENCLOSURES

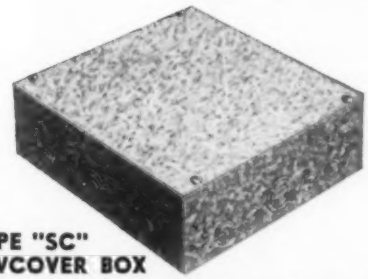
STEEL or ALUMINUM

Contractors, Industrials, Utilities, Municipalities, REA's

CABINETS AND BOXES

TYPE "PF" TELEPHONE CABINET

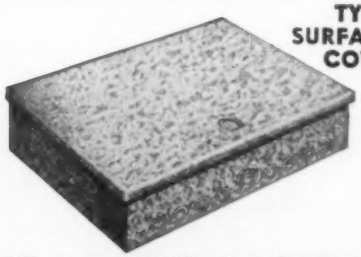
Surface or Flush Mountings in either galvanized or grey enamel finish. Constructed from the finest steels available, all in compliance with the Underwriters Laboratories specifications.



TYPE "SC" SCREWCOVER BOX

Durable Formed Construction, galvanized or grey enamel finish, with or without knockouts. Sizes to your specifications.

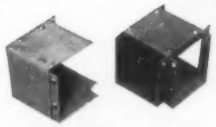
TYPE "A" SURFACE HINGE COVER BOX



All sizes available for electrical cutouts, switches, relays, junction and pull box applications, galvanized or grey—with or without knockouts.

WIREWAYS and DUCT

TYPE "SD" SCREW COVER AUXILIARY GUTTERS



ELBOW and TEE

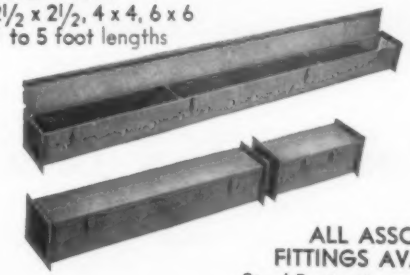
"U" CONNECTOR

END CAPS

For Switches, Panel Boards or Straight Runs, you can't match the flexibility, greater capacity and easy installation of B&C wireways. Die formed construction of heavy gauge sheet steel, as specified by the Underwriters Laboratories and the National Electrical Code.

HINGED COVER WIREWAYS

TYPE "HCW"
$2\frac{1}{2} \times 2\frac{1}{2}$, 4 x 4, 6 x 6
1 to 5 foot lengths



ALL ASSOCIATED FITTINGS AVAILABLE
Steel Protection of Electric Conductors, plus Accessibility.

Economical to install and maintain — tapping, splicing, additions, inspections, may all be made within the limitations of the National Electrical Code.

Write for descriptive catalog containing installation data and current price list.

Your Seal of Dependability and Safety

B and C METAL STAMPING COMPANY

590 MEANS ST., N. W. • ATLANTA, GEORGIA

Yesterday it was only a dream . . .

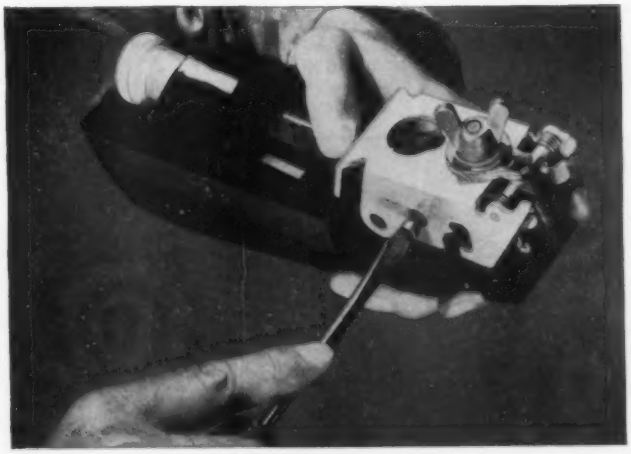
Today Westinghouse brings you an *all-purpose* cutout (**Type EU**) — *one* box and door to handle *all* your enclosed fuse cutout applications! No need to sleep in the warehouse, trying to keep up with the stocking needs for your system with four different boxes and twelve doors to match!

Think of the savings! Just one style box and door for all voltages — 2.6, 5.2, 7.8 kv — all currents up to 100 amperes continuous — with maximum interrupting capacities up to 14,000 amperes. The same cutout for dropout or non-dropout operation. It means simplified purchasing, smaller repair stocks . . . far easier maintenance.

No wild-eyed dream, this! We *know* Westinghouse universal cutouts will interrupt rated faults . . . over and over again. Beginning with carefully developed theoretical designs, we thoroughly proved their performance in grueling "controlled-fault" interruption tests at the Westinghouse High Power Lab. This is your assurance of full value for your protection investment.

A real value it is, too! Call your Westinghouse Sales Engineer today for complete details about this fabulous new cutout and its equally fabulous price. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60966

TO REPLACE ALL OF THESE ?



Dropout or non-dropout with a twist of the wrist

By simply removing one screw, the new Westinghouse EU universal cutout can be converted from non-dropout to drop-out operation. The Moldarta* door is designed for easy manual closing or hook stick insertions.

*Trade-Mark

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

a wholly owned subsidiary was dissolved June 30th into the A. B. Chance Co., and will operate as the American Crossarm and Conduit Division of the A. B. Chance Company.

Fred Masterson who was President of the American Crossarm and Conduit Company has been made a vice-president of the A. B. Chance Co.

The Chehalis, Wash., plant, like the American Crossarm plants, make a full line of wooden crossarms, cross braces, ground wire moldings and related items. It has facilities for extensive kiln drying and pressure treating.

Manufacturers appoint new representatives

THE ESTERLINE-ANGUS Co., Inc., has recently appointed the Hildenbrand Co., Fairfax, Va., as product representative in their Maryland-Virginia territory, including the District of Columbia.

* * *

A COMPLETE ROSTER of representatives for the Southeast has been appointed by Husky Products, Inc., 5300 Vine St., Cincinnati, Ohio, manufacturer of support systems for power and control cables.

The new representatives and the states they cover are as follows: Georgia, R. H. Osgood, Osgood & Associates, Inc., 988 Spring St., NW, Atlanta 9, Ga.; Alabama, Charles W. Ashby, Charles W. Ashby Co., 1827 28th Ave., So., Birmingham 9, Ala.; Tennessee, C. E. Pitner, P. O. Box 693, Knoxville, Tenn.; North Carolina, E. T. Green, P. O. Box 5304, Greensboro, N. C.; South Carolina, R. N. Love, Engineer Sales Co., P. O. Box 5085, Columbia, S. C.; and George E. Weeks, George Weeks & Associates, P. O. Box 5851, Jacksonville 7, Fla.

In other states of the U. S., most of the leading cable manufacturers act as sales representatives for Husky products and sell them through their own field offices.

RAB ELECTRIC Manufacturing Co., Bronx, N. Y., announces the appointment of Alfred H. Stone, Hollywood, Fla., as their Florida representative. Mr. Stone also

A. H. Stone

represents Mulberry Metal Products, Union, N. J.; Wolta Electrical Products, Mount Vernon, N. Y.; and Royal Products Co., Inc., Newark, N. J. His headquarters are 327 Cleveland St., Hollywood, Fla.

* * *

SORGEL ELECTRIC Co., Milwaukee, Wis., has named Marchant Industrial Sales Co., Richmond, Va., their representative for the state of Virginia.

* * *

S & C ELECTRIC Company has appointed W. C. Milks sales engineer for Western Missouri, Kansas, and Oklahoma. His offices will be in Kansas City at the Central Sales Division office, 406 West 34th St. Milks is a graduate electrical engineer from Washington University in St. Louis, with some 10 years of experience in equipment design, consulting, contracting, and engineering sales work.

* * *

NORMAN PARKE has been appointed Southeastern representative for Spartan Electric Radiator Corp., Maspeth, N. Y., according to an announcement by Allen Leighton, president. Mr. Parke, who will maintain headquarters at 333 Candler Bldg., Atlanta, Ga., will cover eight Southeastern states.

THE CHASE-SHAWMUT Co., Newburyport, Mass., has announced the appointment of Wilson P. Byrd, Greensboro, N. C., as their sales representative for the states of North Carolina and South Carolina.

* * *

AL LEVIN and Associates, Inc. has been appointed as representative for the Newart line of outlet boxes, switch boxes, covers, and bar hangers, and they will have a complete warehouse stock in New Orleans. The Levin company has moved recently into a new office at 301 Gaiennie, corner of S. Front, and also has opened a new warehouse at 1201 S. Front St.

Brief news notes of manufacturers

HUBBARD AND COMPANY, Chicago, Illinois, has announced the purchase of Electrical Engineers Equipment Company, of Melrose Park, Illinois, manufacturers of electrical equipment for transmission and distribution lines in the utility and industrial fields.

No change in the organization is contemplated. Now, as a part of Hubbard and Company, it will have full advantage of the completely integrated facilities for testing, developing, and perfecting products at the new Hubbard Electrical Research Laboratory in McCook, Illinois.

* * *

ANDERSON ELECTRIC Corporation, Birmingham, Ala., has begun construction of a new addition to its Leeds, Ala., aluminum connector foundry and assembly plant. The addition will be an all-steel building, 70-ft. x 100-ft. It will house automatic equipment, designed and built by Anderson's own engineering personnel for the production of high-volume distribution connectors.

Space in the new building has also been designated to accommodate a portion of the company's growing program in the development of electrical connectors.

E. T. Green | R. H. Osgood | C. W. Ashby | R. N. Love | G. E. Weeks | C. E. Pitner

News about people

A. Dexter Hinckley, executive secretary of the **Illuminating Engineering Society** for the past 14 years, has been named managing director of the IES. The post of managing director was recently created by the society's governing body to relieve its president of many detailed operating duties that have developed as the 52-year-old society has grown to include some 9,000 members in 83 sections and chapters in the United States and Canada. Mr. Hinckley's appointment was announced by **George J. Taylor,** IES president.

A. Dexter Hinckley

Creation of the office of managing director was proposed by the society's advance planning committee and authorized by its governing body at the IES Annual Technical Conference in Toronto August 22.

Responsibilities of other members of the senior staff at the society's headquarters here remain unchanged, but a new position—membership secretary-office manager—has been created to replace the office of executive secretary which will be eliminated.

The new managing director became associated with the IES as a member in 1931 while teaching electrical engineering at Columbia University. In 1939, Mr. Hinckley served a one-year term as chairman of the society's New York section and later became national general secretary and a director of the organization.

H. P. Whitehead, operating manager of the **Georgia Power Company** for the past four years, has been elected a vice-president by the board of directors. **Robert J. Cooper** succeeds Mr. Whitehead as operating manager.

Mr. Whitehead joined the company November 1, 1929, as an equipment specialist and was successively advanced to foreman of the general repair shop, general foreman, supervisor of special construction, and as-

Choose from the GREENLEE

COMPLETE LINE

of fast LIGHTWEIGHT

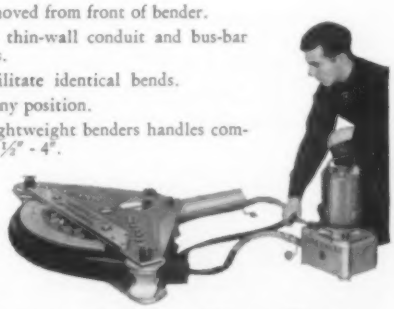
hydraulic benders

90° bend with one ram stroke

NEW No. 883 for 1/2"—3" pipe and rigid conduit.

Completes the GREENLEE uniqu[illegible] of fast, convenient, lightweight hydraulic benders. Makes quick, smooth, a[illegible]ate bends of any size up to 90° with one ram stroke. Operates with GREENLEE No. 798 Power Pump or No. 768-M4 Hand Pump. Easily wheeled from job to job on pipe supports specially designed to serve as rollers. Has all these advantages in common with the other GREENLEE lightweight benders:

- High-strength aluminum and steel construction for minimum weight, maximum strength.
- Any bend up to 90° made quickly with the GREENLEE Hand Pumps . . . *in seconds* with the GREENLEE Power Pumps.
- Easily portable by one man.
- Fast one-man setup — rotating universal pipe supports with quick-change removable pipe support pins.
- Conduit or pipe inserted and removed from front of bender.
- Ram fits GREENLEE thin-wall conduit and bus-bar bending attachments.
- Built-in gauges facilitate identical bends.
- Benders operate in any position.
- GREENLEE line of lightweight benders handles complete range of sizes, ½" - 4".



No. 884
For sizes ½" - 4". Operates with GREENLEE No. 798 or No. 797 Power Pump or No. 726 Hand Pump.

No. 880
For sizes ½" - 2". Operates with No. 768-M4 Hand Pump or No. 798 Power Pump. Easily carried by one man.

TOOLS FOR CRAFTSMEN
GREENLEE

GREENLEE TOOL CO.
1791 Columbia Avenue, Rockford, Illinois

sistant superintendent of the Atlanta division. He was transferred to Augusta in 1949 as division superintendent, remaining there until 1952, when he returned to Atlanta as general superintendent of transmission and distribution. He was appointed assistant operating manager in 1953 and operating manager in 1954.

Before joining Georgia Power in 1925, Mr. Cooper worked for Westinghouse Electric Corporation and was an instructor at Alabama Polytechnic Institute. He began work with the company as a tester and has since then held various engineering positions. He became assistant operating manager in 1957.

Franklin Research Corp., Boston, Mass., announces the appointment of **Winthrop W. Sargent** as general manager of **Wheeler Reflector Co.**, manufacturers of fluorescent and incandescent lighting fixtures and a

W. W. Sargent

division of Franklin Research Corp.

Sargent was formerly treasurer and plant manager of **Spinform, Inc.**, Attleboro, Mass. Prior to that, he was vice-president of **Abbot Worsted Co.**, Forge Village, Mass.

Leon Kolmaister has been named to succeed **Al Orlick** as southern representative for the **Leviton Manufacturing Company.** Mr. Orlick's recent death marked the end of a twenty-three-year association with Leviton.

Carter-Moody Agency, of Lake Wales, Fla., which represents several electrical manufacturers, has announced the addition of **Stephen Watsey** to their sales staff. Mr. Watsey is a graduate of the United States Military Academy where he received his B. S. degree in engineering. After graduation, he was commissioned in the U. S. Air Force, and served with distinction in Korea, receiving the Distinguished Flying Cross, two Air medals and the Presidential Unit Citation.

Following his discharge from the Air Force, he was employed in transmission engineering with the Florida Power and Light Co., Miami. In his new position, Mr. Watsey will cover the central and west coast areas of Florida for the Carter-Moody agency, which represents B and C Metal Stamping Co., Bethea Co., Inc., Central Transformer Corp., Electrical Utilities Co., Lotran, Inc., and the James R. Kearney Corp.

Kaiser Aluminum and Chemical Sales, Inc., has announced the appointment of **D. C. Keenan** as manager of the newly established Dallas

D. C. Keenan

sales region of the Electrical Conductor Division.

Keenan was a salesman and later an electrical conductor sales supervisor in Dallas before his promotion to regional manager there. He joined the company in 1952, following two years as assistant to the personnel manager of the **Texas Power and Light Co.**

Appointment of **Harold P. Gustavson** as manager of electric utility sales for the Electro-Motive Division of **General Motors**, has been announced

H. P. Gustavson

by Paul R. Turner, director of sales for Electro-Motive.

Mr. Gustavson, a native of Downers Grove, Ill., and a mechanical engineering graduate of Illinois Institute of Technology, has been with Electro-Motive since 1940, starting in locomotive test. Prior to his recent appointment he was petroleum sales manager, a post he had held since 1955.

Two Southerners were among the 13 members of the **American Institute of Electrical Engineers** elected to the grade of "Fellow" recently by the AIEE board of directors.

Wendell C. Fowler, Southwest district manager for **Sangamo Electric Co.**, Fort Worth, Texas, was cited "for contributions to instrumentation in the field of power."

Lester R. Sellers, engineer in charge of electrical specifications and

RICHARD H. OSGOOD (left) of Osgood & Associates, Atlanta, Ga., manufacturers' representatives, talks with Donald N. Elsea, who has recently joined the Osgood organization. In his new position Mr. Elsea will have North Georgia and Eastern Tennessee as his territory.

procurement, **Tennessee Valley Authority,** Knoxville, Tenn., was cited "for contributions to coordination of design of large hydroelectric and steam plants."

Harmon H. Gnuse, Jr., has been appointed senior power engineer for the **Aluminum Company of America,** and transferred to Alcoa's main office in Pittsburgh, Pa.

Mr. Gnuse joined Alcoa at Franklin, N. C., in 1940, as an assistant electrical engineer for the Alcoa subsidiary, **Nantahala Power and Light Co.** He was named electrical engineer in charge of generation, transmission, and distribution for Nantahala Power and Light Company in 1942, and became vice-president in charge of engineering in 1943. He was appointed a director in 1950, and was made vice-president in charge of operations in 1956, a position he held until his recent appointment.

The promotion of **John B. Rogers** to product manager, Distribution Division, **Anderson Electric Corporation** of Birmingham, Ala., has been announced by **C. E. Bitzer,** vice-president of sales.

An electrical engineering graduate of Alabama Polytechnic Institute,

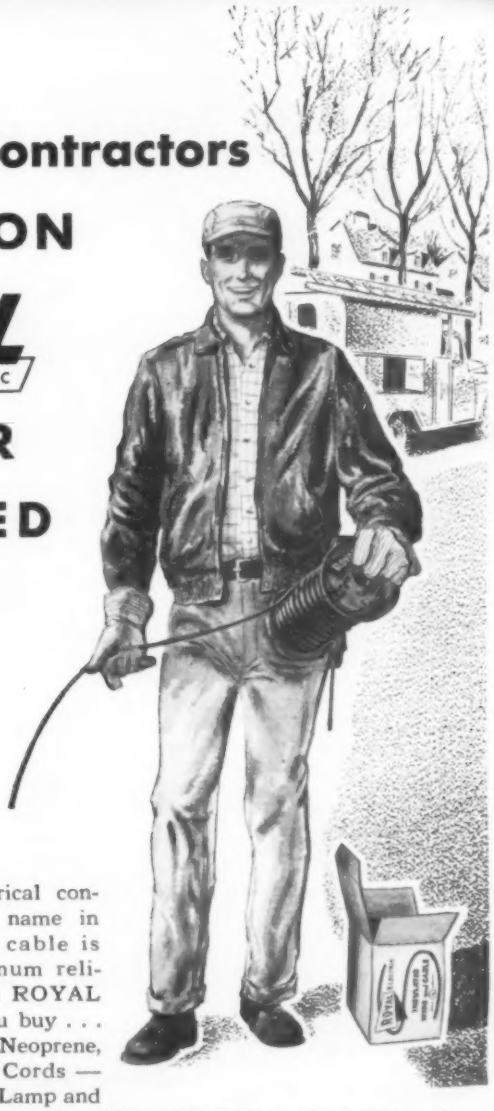
J. B. Rogers

Rogers has been associated with Anderson since 1956, when he joined the company as sales representative in Louisiana, Arkansas, and parts of Mississippi and Tennessee. As distribution product manager, he will now supervise the sale throughout the country of Anderson's overhead distribution equipment.

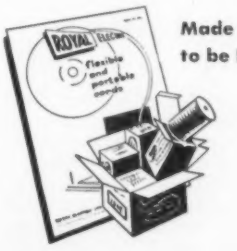
Thomas W. Bowry, former chief of the **Bureau** of **Electrical Inspection** for Richmond, Va., died recently in that city.

Mr. Bowry retired in 1946, after 58 years of service with the city. He was a past president of the **International Association** of **Electrical Inspectors** and also was a past president of the Southern Section of that organization.

Electrical Contractors DEPEND ON ROYAL ELECTRIC RUBBER JACKETED CORD



Among leading electrical contractors, the trusted name in portable cord and cable is ROYAL. For maximum reliability, look for the ROYAL name on the cord you buy . . . whether it's Rubber, Neoprene, or Plastic Jacketed Cords — Thermostat Cable — Lamp and Fixture Wires — or heavy duty "Powr-Kord" Extensions. Take advantage of Royal quality products and quality packaging for faster, easier and more dependable wiring. Order Royal Cord from your wholesaler, today . . . or write us for Catalog 4-54, giving your wholesaler's name. **Royal Electric Corporation, Pawtucket, R. I.**



Made Right . . .
to be Right on the Job!

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ROYAL ELECTRIC CORPORATION
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Atlanta
New Orleans-Greensboro
Birmingham

Suchman & Coulter, Inc.
Miami
Nuro Company
Houston-San Antonio-Dallas

Technical books

for the electrical man

Tape recorders

"Tape Recorder Service Manual, Volume II," Published by Howard W. Sams and Co., Inc., 2201 East 46th St., Indianapolis, Ind., 160 pages, $2.95.

This new series is being produced to meet the increased demand for more comprehensive material on current-model tape recorders.

Volume II covers a basic tape recorder chassis and one stereophonic tape player chassis produced in 1957—a total of 16 models. Both home and professional type tape recorders are covered. Complete authoritative information includes general operation data, use of external speakers, mechanical and amplifier adjustments, cleaning, lubrication, etc. For each recorder covered there is complete information on troubles and probable remedies, plus complete mechanical and electrical parts lists.

Photos show actual recorder, amplifier. Exploded view drawing gives complete assembly and parts list information. Amplifier schematics are included where specific amplifiers are used. A complete index of tape recorder coverage in the two volumes and previous Sams publications is included.

Electromatic fields

"Introduction to Electric and Magnetic Fields," by Samuel Seely. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y., 308 pages, illustrated, $8.50.

In addition to providing a sound background in electricity and magnetism, this book also serves as the foundation on which to develop later work in field operated devices, such as traducers and rotating electrical machinery, and the important problems of electromagnetic field theory. The book covers the usual important topics, such as: current flow fields, electrostatics, electromagnetism, and introductory electromagnetic field phenomena.

The author presents the material is an order of increasing complexity of field concepts. Since development proceeds in terms of vector methods, the necessary vector mathematics is introduced.

Development proceeds from considerations of a study of the current flow field, to the static electric field, the static magnetic field, and then dynamic fields. This provides an excellent means for understanding scalar and vector fields.

Considerable emphasis is placed on the concept of energy storage in fields and the relationship to forces, and the energy flow concept. This provides the essential background for the study of field operated devices. Many illustrative examples of very important practical applications of the theory are used to show the formulation and the solution of problems.

Introduction of material through field plotting experiments presents the scalar potential field first, and makes clear the relation between the scalar field and the vector field. The introduction of vector mathematics as needed in the development serves to provide the reader with this powerful shorthand mathematical method, and to make him familiar with the form in which all more subsequent advanced books are written and developed.

The emphasis is on the charge as the basic element of the theory, with considerations of problems of charges which are stationary in space, in uniform motion, and in accelerated motion. This provides a unified approach in the development. The treatment of energy and mechanical forces in electric and magnetic fields is more extensive than is usually available in a book at this level.

Guide to physics

"Handbook of Physics." Edited by E. U. Condon and Hugh Odishaw, Published by McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y., 1504 pages, illustrated, $25.00.

Two distinguished editors, working with many of today's outstanding scientists, present in *Handbook of Physics* a comprehensive and authoritative guide to basic physics. Comparable in treatment and scope to the handbooks serving other professions, this monumental volume deals with the principles, ideas, concepts, and advanced mathematical methods of all branches of classical and modern physics.

The book provides concise answers to hundreds of questions in the various areas of physical science. By its treatment, it serves as a check for a better understanding of basic concepts, problems, mathematical formulations, and equations, and offers a means of reviewing or gaining an understanding of unfamiliar areas. Extensive bibliographic references guide the reader to detailed literature on the many topics treated.

The emphasis in the book is on the principles of physics and the mathematical techniques required for their exposition. Within this framework, the main sections cover mathematics, mechanics of particles and rigid bodies, mechanics of deformable bodies, electricity and magnetism, heat and thermodynamics, optics, atomic physics, physics of the solid state, and nuclear physics.

The enormous task of organizing and editing the vast amount of material was handled by E. U. Condon and Hugh Odishaw. Dr. Condon is the Wayman Crow professor of physics at Washington University in St. Louis. He is also the former director of the National Bureau of Standards. Hugh Odishaw, formerly the assistant to the director of the National Bureau of Standards, is now the executive director of the United States National Committee for the International Geophysical Year, National Academy of Science.

Sound handbook

"Technilog," University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N. Y., 64 pages, $1.00.

University announces a new sixty-four page fact-packed manual, the "Technilog" which is said to be the most complete practical guide to sound planning ever produced. Comprising much needed practical technical and product information, charts, tables, etc., it is written in a concise, easily understood manner and represents the experience of two decades of loudspeaker research, development and practical application.

The subjects discussed very fully include: how to apply driver unit specs; overload protection; line matching problems; correct phasing; best use of available power and effects of mismatch; adjusting power capacity and cut-off; how and which type of speaker to apply where; control of reverberations; using speakers as high output microphones; baffling cone speakers, etc. At the end of each section there are complete architects' and engineers' specifications.

The University "Technilog," a "must" for sound engineers, technicians, architects and servicemen, can be obtained from local radio parts supply houses or direct from University Loudspeakers, Inc.

Free bulletins

A new 48-page booklet from **Champion Lamp Works,** Lynn, Mass., presents the principles and advantages of **good lighting practice.** Much useful information has been added including a guide to trouble shooting fluorescent installations; a section on planning the group replacement of lamps; and a section on planning a program for cleaning lamps and fixtures.

For additional data, ask for item B-1115, using the coupon on page 103.

A new general catalog covering **recessed and surface lighting fixtures,** portable lamps, pin-up lamps, and accessories, has been released by **Prescolite Manufacturing Corp.,** 2229 Fourth St., Berkeley 10, Calif. The catalog, produced in five colors, with detailed line drawings, also gives special construction details, features, and design advances in the Prescolite line.

For additional data, ask for item B-1116, using the coupon on page 103.

A 28-page catalog—in color—has been published by **Conduit Fittings Corporation,** a division of U. S. Industries, Inc., 6400 W. 66th St., Chicago 38, Ill. The easy to read catalog illustrates and describes the company's entire line of **fittings and accessories,** including the new pressure cast E. M. T. connectors and couplings and other new items.

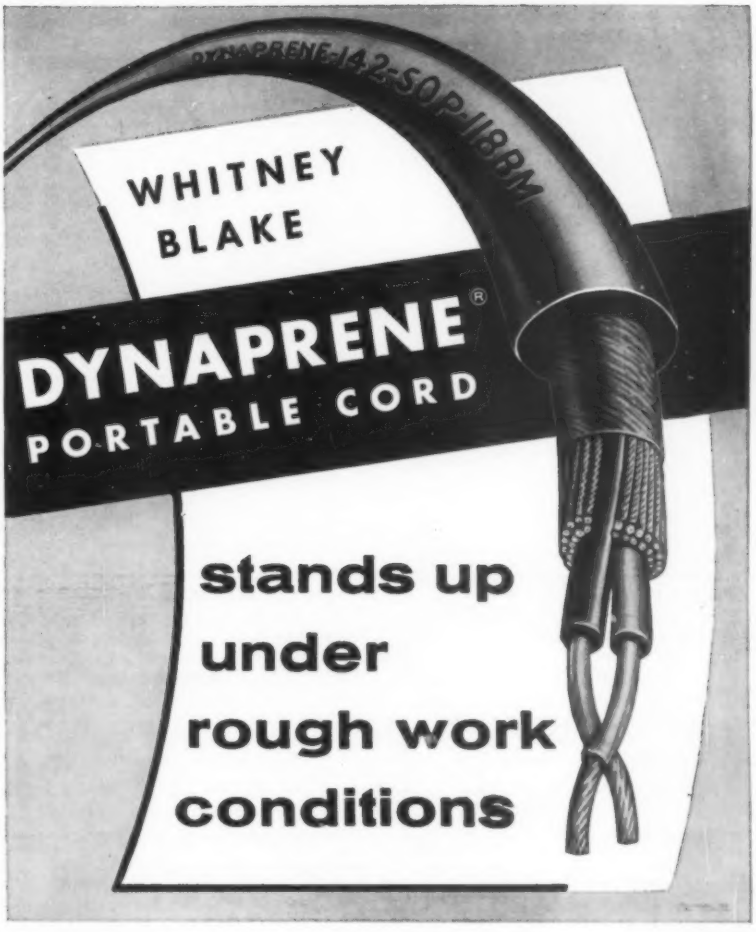
For additional data, ask for item B-1117, using the coupon on page 103.

A new 12-page pictorial bulletin briefly describes **manufacturing facilities and electrical products** of **Crouse-Hinds Company,** Syracuse 1, N. Y. Emphasis is on the variety of equipment available in the four product lines: condulet electrical equipment, floodlights, aviation lighting equipment, and traffic control. Installation photos show these products in use.

For additional data, ask for item B-1118, using the coupon on page 103.

Electro Lighting Corporation, 1535 South Paulina St., Chicago 8, Ill., announces its new Electro-Log, a compact presentation of their **line of lighting equipment.** The Electro-Log, only 8 pages, is designed for and available to all those who sell, specify, install, or maintain lighting. A unique feature of this condensed catalog is that it can be easily addressed with a typewriter and folded for use as a self-mailer.

For additional data, ask for item B-1119, using the coupon on page 103.



Where portable cord takes a beating because of rugged work conditions, WHITNEY BLAKE DYNAPRENE stands up and gives long, economical service.

DYNAPRENE has an especially tough neoprene jacket, it resists abrasion, has high flexibility and long flex life, and provides premium quality service at competitive prices.

Write TODAY for this complete catalog . . . FREE.

WELL BUILT WIRES SINCE 1899

WHITNEY BLAKE COMPANY

NEW HAVEN 14, CONNECTICUT

A new booklet by **Kaiser Aluminum,** 919 N. Michigan Av., Chicago 11, Ill., has been published giving availabilities, technical data, material economies, and advantages of **aluminum service entrance cable.** A full-page chart furnishes cable construction details, dimensions, weights, and current carrying capacities of Kaiser Aluminum's service entrance cable, style U. Other pages discuss typical farm, home, and industrial applications and list the aluminum SE-U accessories now available.

For additional data, ask for item B-1120, using the coupon on page 103.

A new, 144-page, pocket-size **catalog and wiring guide** No. 21 is now available from **The Wiremold Company,** Hartford 10, Connecticut. The catalog covers the complete line of surface metal raceways and fittings, plugmold multi-outlet systems, fluorescent and slimline lighting equipment, and wireduct non-metallic flexible conduit, with detailed installation instructions.

For additional data, ask for item B-1121, using the coupon on page 103.

The new edition of its Speedfax catalog has been published by the **I-T-E Circuit Breaker Company,** 19th and Hamilton Sts., Philadelphia, Pa.

The 56-page illustrated catalog contains complete pricing, dimensional, and application information on the company's extensive line of **molded case and large air circuit breakers,** as well as general descriptions of I-T-E switchgear products, tranfo-units and high voltage switching devices.

For additional data, ask for item B-1122, using the coupon on page 103.

Illustrated **procedures on splicing and terminating rubber-insulated, neoprene-jacketed power and control cable** are given in a useful manual available from **Kaiser Aluminum and Sales, Inc.,** Dept. NR-14, 919 N. Michigan Ave., Chicago 11, Ill. The 36-page booklet is printed on sturdy, waterproof paper so that it can be used at the job site for ready reference.

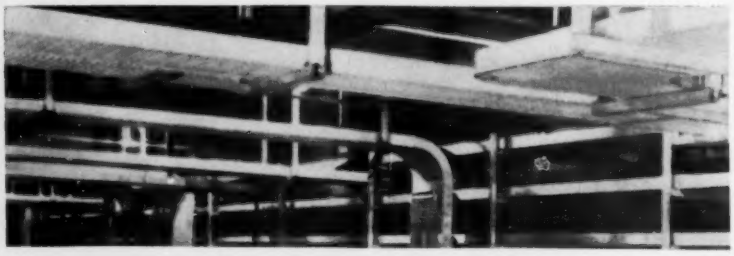
For additional data, ask for item B-1123, using the coupon on page 103.

In a free, eight-page installation and operating guide, the **electric heat product line** of the Hunter Division of **Robbins and Myers, Inc.,** of P. O. Box 3775, Memphis, 14, Tenn., is described and illustrated.

For additional data, ask for item B-1124, using the coupon on page 103.

P-W SUPPORTS CUT COSTS

Add Your Name to our ever-growing list of satisfied customers who say with a twinkle in their eye: "We *saved* by using P-W."



Supports—Expanded and solid metal Trays and Ladder—in *Galvanized Steel* and *Aluminum,* to hold Power and Control Cables and Instrument Tubing. Specified and Approved for All Types of Governmental, Utility and Industrial Jobs.

The only system that *eliminates field cutting* and *provides 100% Galvanized Coverage.* Goes up like erector set. Pick out piece and install with drive rivets. (*Does away* with measuring, cutting, drilling and time-consuming bolts, nuts and washers or hinges.)

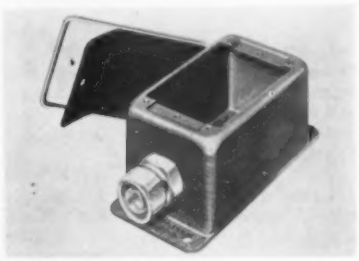
Write today for New Catalog No. 858 and literature. *Save Money* by Contacting our Representative or P-W direct.

P-W INDUSTRIES, INC., Manufacturers
Duncan and Melrose Sts., Philadelphia 24, Pa.

New products

Junction boxes safety engineered throughout

A NEW LINE of rugged, liquid-tight, dust-proof junction boxes is being introduced by Appleton Electric Co., 1701 Wellington Ave., Chicago 13, Ill. This "JIC" Series, as it is known, has been approved for use either as a junction box or a wiring device box. The three types of boxes in the line are safety engineered throughout to provide positive protection from liquids, fumes, shavings, dirt, and other foreign matter for electrical connections.



The new Appleton "JIC" wiring boxes, now available, have box bodies of one-piece welded construction with exceptional wiring room. All sharp edges or corners, inside or out, which could injure hands or damage wires have been eliminated. Exclusive full-width bridge gives additional screw support and perfect Sealtite alignment. "JIC-S" boxes are equipped with one Appleton Uni-Seal "STN" Sealtite conduit connector. "JIC-H" boxes have one Appleton Uni-Seal rigid conduit hub. Both "JIC-S" and "JIC-H" Series boxes have been thoroughly approved in accordance with U. L. and "JIC" specifications. Additional hubs and connectors may be mounted on the boxes at desired locations by the user.

Box covers specially adapted for the "JIC" Series boxes have captive screws and large neoprene gaskets for added wiring protection. This type of cover is available either with a large device hole or blank.

For additional data, ask for item P-1125, using the coupon on page 103.

Asbestos fixture wire packaged in modern fashion

A COMPLETE LINE of asbestos fixture wire has been introduced by the Carol Cable Company, 190 Middle St., Pawtucket, R. I. The line, which will have national distribution through Carol's warehouse network, includes 18, 16, 14, 12 and 10 gauge in black, white, red, green, and blue.

Carol is packaging the AF wire in its new carton designed for easier

handling and better product recognition. Color coded labels show gauge, color, and quantity at a glance to save time, simplify inventory keeping, and reduce costly shipping and identification errors.

Packaging in this modern fashion keeps weight at a minimum for easy handling and protects unused spools. Ten and 12 gauge wire is packed one spool per carton; 14, 16, and 18 gauge wire is packed only two spools per carton. All spools carry 500 feet of wire.

For additional data, ask for item P-1126, using the coupon on page 103.

Circuit breaker provides continuity of service

THE FIRST metal-enclosed six-pole anode circuit breaker to permit drawout of individual poles without interruption of process power has been announced by I-T-E Circuit Breaker Co., 19th and Hamilton St., Philadelphia 30, Pa.

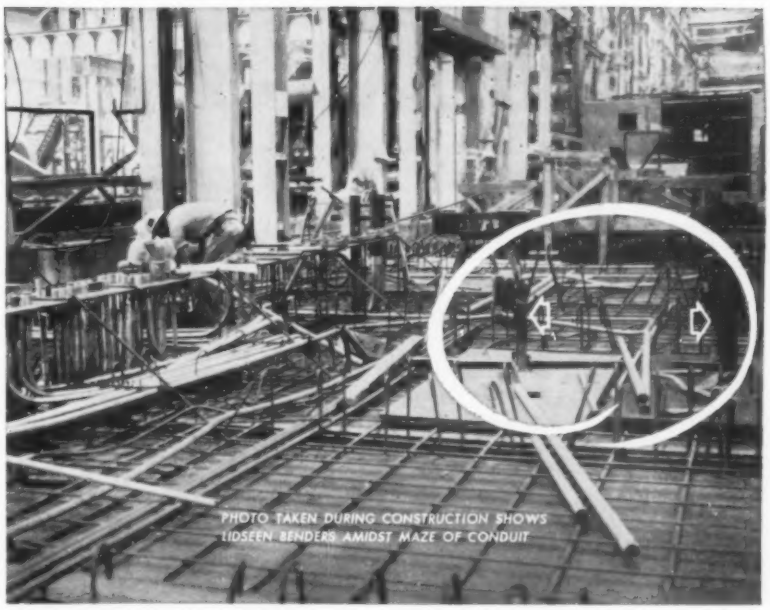
The single-pole drawout, providing continued supply of d-c power while one phase is being serviced, will eliminate costly downtime on

aluminum reduction and other electrochemical production processes where the high-speed anode breaker is used for fault protection of mercury arc rectifiers.

In addition to continuity of service, other advantages of the I-T-E single pole drawout include: quicker servicing—only three minutes to completely replace one breaker pole; greater flexibility in arrangement of individual breaker poles within the metal enclosure; less aisle space needed to remove and turn the breaker; smaller inventory investment—only one or two spare breaker poles need be stocked.

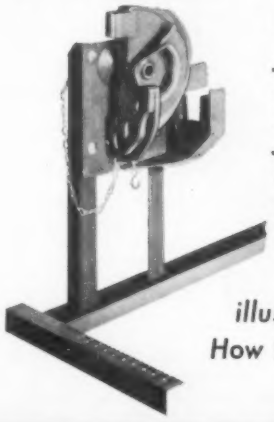
Representing a complete redesign, the new six-pole anode circuit breaker, designated type FB, also is lighter in weight, simpler in overall construction and smaller in floor space requirements.

For additional data, ask for item P-1127, using the coupon on page 103.



LIDSEEN "Chicago" Benders on the job during construction of $200,000,000 Kaiser Aluminum Plant

By assisting the Foothill Electric Company, the Lidseen "Chicago" Pipe Bender played a vital role in the installation of this huge, complex electrical system of the new Kaiser Aluminum Reduction Plant and Rolling Mill. Being the largest single industrial development in West Virginia it required about 2,000,000 pounds of conduit and over 5000 precision bends. Over 30 lineal miles of aluminum conduit alone was used. The Lidseen bender is and proved to be a real on-the-job tool . . . it's rugged, has ideal working height, gives accurate bends every time . . . no strain, slipping or loose parts to worry about. Ask the electrician who is using one; he will tell you it's the finest tool available and at a price that is eminently reasonable.



BENDING CIRCLES: INSIDE RADIUS

	No. 1	No. 1T
½" conduit or pipe	2"	EMT 3"
¾" conduit or pipe	4⅛"	EMT 4½"
1" conduit or pipe	5¾"	EMT 6½"
	No. 2	**No. 2T**
1¼" conduit or pipe	7¼"	EMT 9½"
1½" conduit or pipe	8¾"	EMT 10½"

Illustrated: No. 1 for bending ½", ¾" and 1" rigid conduit

Write for FREE illustrated Folder on How to Bend Conduit

LIDSEEN
OF NORTH CAROLINA, INC.
1020 FIRST STREET, HAYESVILLE, NORTH CAROLINA
PHONE HAYESVILLE 2000

Fluorescent ballast guaranteed weatherproof

THE JEFFERSON ELECTRIC Co., Bellwood, Ill., has announced the new Nor'easter, a fluorescent ballast that is weatherproof and guaranteed against service failure due to weather conditions for 2 years.

The entire case of the Nor'easter is

hot-dip galvanized for corrosion resistance, and after ballast assembly, the seams of the lid are brazed to form a completely sealed unit. Jefferson's Aqualift Sealant prevents moisture from entering through the pipe nipple where the leads exit. The neoprene leads are said to withstand exposure to weather and temperature changes without deterioration. Extra heavy mounting brackets are provided.

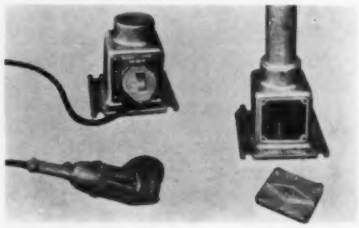
The new models—all one case construction—are considered ideal for highway lighting, area lighting, billboards, and plastic signs and are available for 800, 1400, and 1500 ma lamps.

For additional data, ask for item P-1128, using the coupon on page 103.

Metal pipe base redesigned for easy installation

THE HOPE METAL Pipe Base from Hope Electrical Products Co., 39 Long Av., Hillside, N. J., has been redesigned for greater rigidity between base and pipe upright, easier installation, and prevention of corrosion at the threaded joint.

The malleable iron base with am-



ple junction chamber, contains a hub threaded to receive a length of ordinary pipe or conduit upright, to form an inexpensive standard for outdoor lighting or for mounting signs, signals, police call, or fire boxes. The redesigned hub provides full pipe thread engagement within the base, to seal out moisture and prevent corrosion.

The chamferred inner edge of the hub's top provides a well to receive packing. Mounting holes in the base have been replaced by slots, eliminating the need for exact placing of mounting bolts.

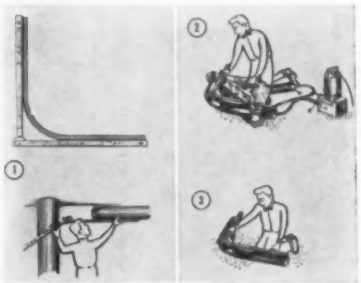
Available in four sizes with either a plain junction chamber cover or one containing a weatherproof 3-pole receptacle to permit plugging in hand tools, electric mowers, or auxiliary lights.

For additional data, ask for item P-1129, using the coupon on page 103.

Angle gauge saves time bending pipe and conduit

GREENLEE TOOL Co., 2136 12th St., Rockford, Ill., has developed the No. 1802 Angle Bending Gauge that saves time when bending pipe and conduit. A special notched protractor design allows the exact degree of bend to be locked in. Made of durable zinc plated steel with black figures, the gauge has an over-all length of 70½".

The gauge has three basic time-saving uses that apply to almost



every bending job. Determining the degree of bend needed is simplified by setting the protractor to angle desired and locking it in position. During the bending operation the gauge can be placed on the frame for easy checking and reference. Each gauge has informative bending data plus a handy rule. After bend is completed, the gauge can be used to check the angle for accuracy.

For additional data, ask for item P-1130, using the coupon on page 103.

Design simplification makes possible lower-cost series

METALS AND CONTROLS Corp., Spencer Div., Attleboro, Mass., announces design simplification of current-type motor starting relays which allows the production of a lower-cost series, the Klixon 9660, for a wide range of voltage variations and special motor characteristics.

Models in the 9660 Series are now

commercially available in narrow differentials with stable pick-up and drop-out ratings from as little as 1.01 amp maximum pick up (switch close) 0.86 amp minimum drop-out (switch open) to as much as 24.4 amp maximum pick-up—20.3 amp minimum drop-out.

These relays are for use on single-phase, a-c, hermetic refrigeration motors and in place of centrifugal starting switches on other single-phase, a-c motors of the split-phase or capacitor-start type.

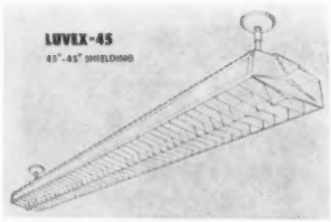
Bonded top-lay contacts provide clean, positive contact breaks for trouble-free operation. The 9660 with welded coil connections and long-lasting contacts is engineered for 1,000,000 operations. The units are small in size and have easy one-screw mounting.

For additional data, ask for item P-1131, using the coupon on page 103.

Day-Brite's Luvex designed for school and office use

THE ADDITION of a completely new lamp fixture line has been announced by Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo.

The new 45° x 45° shielded 2-lamp fixture brings even higher levels of visual comfort to this line



of fixtures. Known as the Luvex-45, this model incorporates the same styling and features as the other fixtures in the Luvex line. All louvers are interlocked with the side panels and wireway cover. Finish is hot, bonded white enamel.

As with all Luvex fixtures this unit may be relamped without removing the enclosure. Luvex-45 is available in both 4-foot and 8-foot lengths with either slimline or rapid-start lamps. This fixture is ideal for schoolroom, library, and office installations.

For additional data, ask for item P-1132, using the coupon on page 103.

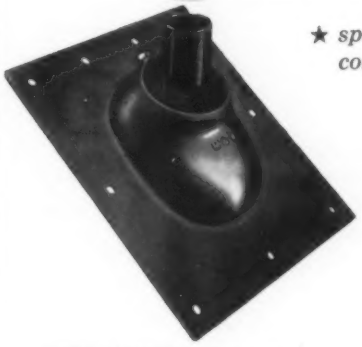
Tap action switches fit any toggle wall plate

A NEW ADDITION to its line of Quiette tap action switches is announced by The Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

This new switch—the Junior Quiette Tap Action Switch—like the Arrow-Hart Senior Tap Action Switch, operates at the slightest pressure of finger-tip, hand, or el-

Model RP 125
Roof Plate and Flashing

new M&W one-piece fitting



★ *speeds installation, saves costs, combines two separate fittings in one*

You'll make service entrance jobs easier, faster, better with this field-proved two-in-one fitting. It combines roof plate and flashing in a single aluminum casting. Takes only minutes to install: just lag-screw to roof and seal with weather-tight compound around mast. It's extra-strong, too—tests prove less lever action on the mast, greater strain resistance. Available in 1¼, 1½, 2 or 2½" sizes—separately or in a complete selection of M&W Mast Kits.

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(November 1958)

bow anywhere on the button. This new switch is small, compact, and constructed to insure long life and maximum electrical efficiency.

Designed to fit any toggle wall plate, the Junior Quiette tap action switch is supplied with binding screw-type terminals in single or double pole, 3-way or 4-way, with brown or ivorylite operating buttons. If desired, operating buttons are supplied with luminous inserts.

This new Junior Quiette tap action switch is rated at 15 amperes, 120-277-volts a-c.

For additional data, ask for item P-1133, using the coupon on page 103.

Industrial electric cable is self-supporting

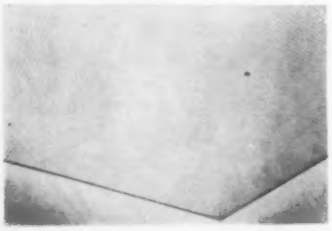
PERFECT-LINE MFG. Corporation of Hicksville, L. I., N. Y., recently announced acquisition of all rights, on a royalty basis, to the manufacture and sale of Lineflex cable from Titeflex, Inc., a subsidiary of the Atlas Corp. Lineflex is a new, inexpensive, and easily installed, metal-sheathed self-supporting industrial electrical cable.

Lineflex is a pre-assembled system of wiring suspension in which both the cable, support, and protective sheathing form a single reel-fed unit. No drilling, leveling, or gang-labor is required in its installation. It is taken directly from its standard shipping reel, pulled into position and quickly attached. It will not sag or slip and requires no periodic adjustments. It may be used catenary-fashion to span longer distances safely, permanently, and may be also employed in mine and elevator shaft cabling without need for structural steel ladders and supports.

For additional data, ask for item P-1134, using the coupon on page 103.

New trim reduces cost of floating luminous ceiling

A DIFFERENT CONCEPT in luminous ceilings—the Infinilite floating luminous panel—has been made possible by the introduction of a new finish



trim by the Integrated Ceilings Corp., 9011 Beverly Blvd., Los Angeles 48, Calif. This development is specifically designed to lower ceiling heights in remodeling and relighting older offices, apartments, professional suites, and similar rooms.

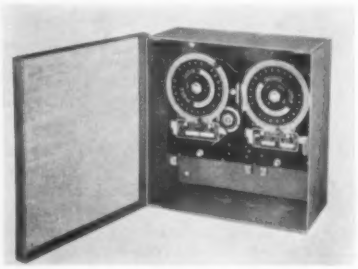
The baked-white enamel, aluminum-finish trim is used with Infinilite non-modular suspended ceiling panels which interlock to form a unique, continuous, uniform ceiling area. No intermediate "T" bars or supporting grid is required. Even, shadowless illumination results through the use of the exclusive circular louver design of the panel.

Use of the new Infinilite floating luminous panel cuts costs by eliminating modular loss, saving costs of cutting and fitting ceiling panels to wall, and generally requiring no alteration of existing air conditioning ducts and diffusers or fire sprinkler systems. In addition, many installations may utilize existing lighting fixtures through the addition of more lighting elements.

For additional data, ask for item P-1135, using the coupon on page 103.

Time switch series works on new principle

A "MOMENTARY CONTACT" time switch series, allowing direct automatic control of low-voltage lighting systems and mechanically-held contactors, has been announced by Tork Time Controls, Inc., Mount Vernon, N. Y. The new series is designed for



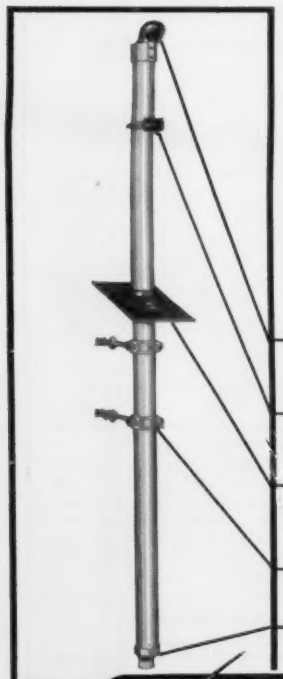
controlling lighting in commercial establishments, offices, or industrial buildings.

The Tork MC series works on a new time switch principle. The 24-hour timing dial automatically provides a three to five second "on" pulse and "off" pulse. On-off times, however, are set in the same manner as a regular time switch—tripper arms are set on the dial the exact time operation is required.

For additional data, ask for item P-1136, using the coupon on page 103.

Small cells give louver textured appearance

AN IMPORTANT advancement in shielding lighting for comfort and beauty is the Cubex aluminum louver by Smithcraft Lighting, Chelsea 50, Mass. Designed for use either in new installations or in replacement of existing lighting, Cubex ½" x ½" x ½" cells provide 45 x 45



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3. **Flexible Synroflashing** — Made of flexible neoprene to absorb vibration. Mast can't work loose, damage shingles, or cause leaks. Won't rot, peel or crack in any weather. Available for 1¼, 1½, 2 and 2½" pipe.
4. **Mounting brackets** — Exposed parts corrosion-resistant aluminum alloy. Shoulder eye fits flat. Lock set screw gives additional grip. Meets installation requirements.
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The better-made parts in a Blackhawk kit let you do a fast and sound job on every service entrance mast installation. Saves you time, builds your reputation for quality and service.

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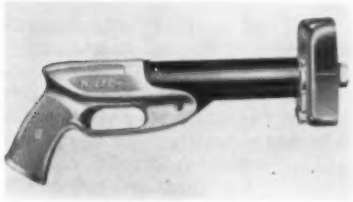
degree shielding in a low-bright, architecturally pleasing medium. The cells of the Smithcraft Cubex louver are small enough to create a textured appearance, yet are large enough to attain a high level of illumination.

Manufactured in 2′ x 2′, 3′ x 3′, and 4′ x 4′ sizes, Cubex louvers are available with a white, non-specular, baked enamel finish and in a wide variety of colors to correspond with various interior decorating schemes.

For additional data, ask for item P-1137, using the coupon on page 103.

Power-actuated tool lightweight and safe

LIGHT WEIGHT, operational simplicity, safety, and low cost, are among the features claimed for the new Drive-It Model 77 powder-actuated concrete and steel fastening



tool now being introduced by Omark Industries, Inc., 5001 S.E. Johnson Creek Blvd., Portland, Ore.

Model 77 drives the full standard range of ¼" and ⅜" drivepins, using only one caliber cartridge. It is easy to load, lock, and fire with safety. Though light, it is actually a sturdy, heavy-duty piece of equipment. With only fourteen parts, it is easy to lubricate and maintain.

Design feature of the Model 77 is an interchangeable, integrated barrel-guard system, which makes possible rapid adaptation of the tool to both general application as well as special electrical lathing, and door-buck work.

For additional data, ask for item P-1138, using the coupon on page 103.

Weatherproof a-c motors withstand rugged conditions

A NEW WEATHERPROOF a-c motor for use in "outdoor" type applications where the motor is subjected to extreme moisture or the elements is now available from Reliance Electric and Engineering Co., 24701 Euclid Av., Cleveland 17, Ohio, in all standard speeds in sizes from one through 250 hp.

It is an open motor that exceeds NEMA splash-proof requirements, and all of its external parts are of corrosion-proof cast iron. Shaft openings are sealed by a shaft cap and slinger.

The insulation system is completely non-hygroscopic. It features silicone sleeving, glass-mica slot liners, and glass mat top-sticks and mid-sticks. The heavy formvar wire coils are repeatedly immersed in special thermosetting, oil-and-water-resistant varnish, then sealed with a final coat of special red finishing enamel.

For additional data, ask for item P-1139, using the coupon on page 103.

Dry-type power transformers have improved sound levels

DRY-TYPE POWER and lighting transformers with new, improved designs and sound levels have been announced by the Hevi-Duty Electric Co., Milwaukee 1, Wis. Outputs range from 6 to 2000 kva. All standard sizes are available in 600-volt, 5 kv, 8.66 kv, and 15 kv insulation classes.

Sound levels are well within NEMA standards. Special transformers with extremely low decibel ratings can be supplied for indoor installation in schools, hospitals, and similar locations.

Modern, well ventilated steel cases protect the transformers externally while rigid blocking of coils and varnish impregnation of the core and coil withstand internal stresses.

Wiring compartments are easily accessible through removable side panels or covers. Primary and sec-

ondary leads are marked for rapid identification and the nameplate carries a simplified wiring diagram to facilitate installation. All units have floor mounting brackets while provisions for wall mounting are supplied on the smaller units.

For additional data, ask for item P-1140, using the coupon on page 103.

Testboard

(Continued from page 32)

d-c clock system to simulate 24-hour operation; and

Soldering iron specifically for use at the board.

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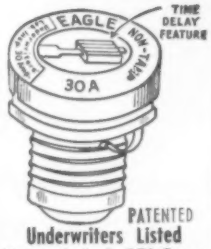
EAGLE

CAT. No. 675

NON-TAMP



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EAGLE Non-Tamp fuses have a patented *thermal element*. This provides a long time lag and prevents needless blowing on temporary starting loads of appliance motors. In addition, EAGLE Non-Tamp fuses protect against ordinary short circuits like regular plug fuses.

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Because of the flexibility and completeness of power and circuity provided at the board, equipment can be tested, processed and repaired, in short order.

Since this maintenance procedure has been in effect, it has proven to be faster, more economical and more efficient than doing the work in the production department and has permitted the electrical maintenance group to do a better job than under the previous more conventional system.

Remote control

(Continued from page 54)

feeder. The receiver-decoder unit is mounted in a watt-hour meter case with a standard five terminal base, and consists of an eight transistor FM receiver, two "Vibrasponder" tone sensitive decoders, and a magnetic latch relay which furnishes an external circuit closure.

A tone signal meant for a particular location actuates one of the "Vibrasponder" units causing operation of the capacitor switching relay. The entire receiver-decoder unit is a plug-in unit, facilitating maintenance since any servicing can be done in the repair shop with a minimum number of spares. The new Motorola system is capable of controlling 20 capacitor banks or combinations of banks on any one distribution system.

Load break switches

(Continued from page 49)

nect switch. The complete resistor assembly is designed to be easily adaptable for mounting on switches which are already installed in the field. At 115 kv for example, the resistor assembly simply mounts on the existing insulator stack which supports the switch break jaws. At voltages of 196 kv and above where the resistor assemblies are somewhat heavier and the cantilever loading on the taller supporting insulator stack is greater, it is desirable to mount the resistor assembly on a separately mounted insulator stack adjacent to the one which supports the break jaw assembly. The use of a separate insulator stack mounted on an extension of the switch base prevents contact misalignment due to wind loading and cable whip which would cause motion of the larger porcelain assembly and conceivably could affect the continuous and momentary current carrying ability of the switch.

Resistor assembly

The resistor assembly is a static device with no moving parts and therefore requires no maintenance. It has no effect on the continuous or momentary characteristics of the switch since it is a parallel connected device which is in the circuit only during the opening or closing interval. The addition of the resistor assembly in no way affects the operating effort of the disconnect switch nor does it affect its ice-breaking ability. No auxiliary apparatus is required for its operation and it uses no insulating oil or high dielectric gas. The resistor assembly can be expected to give dependable performance and long life without maintenance.

A complete resistor assembly is shown installed in a 345-kv disconnect switch (Fig. 5). The normal current path is through the main blade and break jaw contacts of the switch with the resistor bypassed. An enlarged view of the resistor assembly is shown in Figure 6. As the switch mechanism is operated, the opening cycle takes place in the following sequence:

(1) The blade is first rotated to provide a contact wiping and ice-breaking action. This is followed by the disengagement of the main contacts whereupon a small arc is drawn from the ends of the break jaws to the blade tip. The arc lengthens until the blade tip passes the first corona shield or arcing contact on the resistor assembly.

(2) When the gap from the blade tip to the first corona shield decreases to approximately 2 inches, the arc transfers readily to the shield leaving the break jaw contact and thereby inserting the first group of resistors in series with the arc path.

(3) As the blade continues to rise, the arc lengthens between the first electrode and the blade tip until the tip approaches the second shield, when, due again to the decreased gap in air, the arc transfers to this shield, thereby inserting the second increment of resistance in series with the arc. This occurs at a gap separation slightly longer than for the first arc trans-

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PEABODY BROTHERS
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Dallas, Texas

fer, approximately 3 inches.

(4) The same process is repeated as the blade rises toward the top of the resistor assembly. The arc transfers to the top corona shield when the blade tip approaches to within about 8 inches of this electrode. When this point is reached, the entire resistance is inserted in the arc circuit.

(5) As the blade continues to rise still further, the arc lengthens until it can no longer sustain itself and is extinguished. This occurs when the gap between the blade tip and the top electrode is about 24 to 30 inches.

In this manner, the resistance is inserted incrementally and the arc length minimized until the entire resistance is in the circuit. The sequence reverses on closing, and the resistor is not in the circuit electrically when the switch is completely closed.

The resistor assembly consists of carbon block resistors mounted within a sealed porcelain weather casing. Each unit assembly is designed for stacking one on the other in the same manner as lightning arresters. In order to coordinate the resistors with the disconnect as described previously, an arcing contact connected electrically to the resistor elements is mounted on each flange of the stacked assembly. In the higher voltage rating such as 345 kv (which is illustrated) the arcing contact also serves as a corona shield. The arcing contacts are adjustable so that they may be coordinated with the arc of travel of the main switch blade.

The resistor assembly utilizes no insulating oil or high dielectric strength gas and is designed to withstand a voltage across its terminals of at least twice normal line to ground voltage. The ohmic value of the assembly is 1500 ohms or several times the surge impedance of the systems to which the resistors would be applied.

Adequate thermal capacity

It is important in designing the resistor assembly to provide adequate thermal capacity in the resistor elements so that they will withstand the prolonged exposure to current and the resulting heating effects which may be realized upon opening and immediate reclosing of the switch or from several successive operations in a short period of time. For this reason carbon block resistors are used rather than wire wound resistors. The assemblies are designed and tested to have adequate thermal capacity to withstand repeated switch operation without damage.

A line of surge suppressing resistors is now available from 115 kv through 345 kv which applies the design knowledge gained from participation in two successful field test programs. These resistors can be supplied with new disconnect switches or added to existing switches already installed in the field.

The extensive field test programs have demonstrated that a resistor assembly can be coordinated effectively with a disconnect switch to eliminate system overvoltages resulting from disconnecting switch operations under no load conditions. These overvoltages, which have proved harmful to system apparatus, can be prevented by inserting resistance in series with the arc path formed between the stationary break jaw contacts and the moving switch blade top as the switch opens and closes. The addition of the resistor has no effect on other operating characteristics of the disconnect switch itself. Being easily adaptable to existing switch installations, the disconnecting switch resistor should provide a dependable, inexpensive, maintenance-free method of eliminating switching surge overvoltages.

Apprentice training

(Continued from page 23)

services in old apartment buildings; helping with sub-station transformer installations and switchboard installations up to 15,000 volts; doing underground wiring including manholes and ductlines; and working on new construction, jobs with individual metering, control wiring for air conditioning, poleline work, etc. Always working under supervision yet given freedom when they have proved themselves in carrying out jobs independently, apprentices cut and thread pipe, pull wire, help install switches, panelboards, and conduit.

Record of progress

During their apprenticeship a written record is kept of their progress. We gather a composite picture of their abilities and personalities from the shop superintendent, job leaders to whom they are assigned, and journeymen they work with; and I add to this the impressions I get in our interviews. An apprenticeship of 576

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hours must be served. However, the talented and hardworking sometimes qualify for their journeyman's examination within three years, most require four years, and some take five years. Our electricians take a battery of examinations for their journeymen's license in order to work in the District of Columbia, Virginia, Maryland, and Pennsylvania. The test of their readiness and qualifications is the Washington, D. C., exam because it has the highest standards.

We watch the apprentice's development closely for we are eager to retain good material, skilled and well-paid electricians. During the six-month probation period they are paid $1 an hour as helpers; those retained who proved exceptionally adept are increased to $1.46 an hour as apprentices for the first half year; those with promise but perhaps a little slower development are paid $1.30 an hour. Continued development and growth in skill are rewarded with a 5 per cent increase each six months.

We have two classifications in our mechanical staff: journeymen working on jobs for private industry, and those working on jobs for the government. Journeymen on private-industry jobs earn $3 an hour, job leaders or foremen $3.50 an hour. Journeymen with the skill and ability to meet the government wage scale get $3.75 an hour, job leaders $4 an hour.

We are ever alert to build personnel even beyond the highly skilful journeymen. We are seeking skilled men willing to assume responsibility, make decisions, and direct men on a job. We are looking for leaders, for our expansion depends on the number of strong leaders we develop. Our men are conscious of this opportunity from the earliest days of their apprenticeship. We provide the incentive of a profit sharing plan that job leaders and supervisory personnel participate in. Of every dollar net the company earns, a part is theirs.

Employee benefits

Our hospitalization and wage insurance policy is explained to them, and premium notices are paid from weekly wages by the bookkeeper. They may buy policies to the amount they wish and can take the policy with them if they should become separated from our company.

We make available to them tools at cost, and payments may be made from their weekly wages.

The training program fully justifies itself for among our most skillful and dependable are those who came to us green and grew along with us. Some of our most valuable have been with the company for the 11 years of its existence, several have been with us five years and over, and a few under five years. Our job leaders are those who have trained with us.

Wiring a machine shop

(Continued from page 25)

the web of the crane runway I-beam, along both sides for the length of the building. The building was divided longitudinally—each busway feeds two runs of duct. Busway fusible plug-in units are numbered, and the respective machines electrified by each bus plug are similarly numbered.

Throughout the machine shop

EVANS ROOF FLANGES

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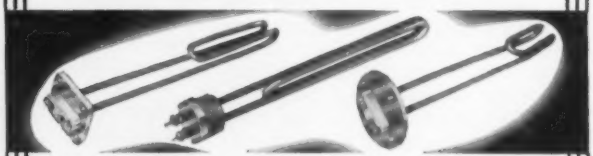

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area, a wood block floor is installed over the concrete. In this area, junction boxes have 4½-inch high rings, and cover plates are flush with the finished floor. A ½-inch adjustment is provided in the Walker single duct junction boxes to provide precise, final leveling. Corners of boxes are drilled to receive 2-inch conduit. On the concrete floor, boxes are furnished with 2-inch rings and are flush with the finished concrete floor.

The power raceway is oval-shaped and has approximately 17 sq. in. cross-sectional area. Duct and boxes are corrosion resistant.

Public utilities meet

(Continued from page 36)

tories are being developed on six different counties in Virginia and West Virginia where various types of industries have located. The purpose is to provide a guide for community leaders and utility managements on the amount of effort justified in bringing in a new plant.

The 450 representatives of utility systems in Virginia and West Virginia attending the meeting also heard James F. Oates, Jr., president, Equitable Life Assurance Society of the United States, New York, discuss philosophy for modern corporate managers. He stressed the necessity of keeping the public informed concerning the essential rightness of the American enterprise system and overcoming the notion that 'bigness" is a bad thing in business. He pointed out that the largest American corporations have achieved their size in proportion to the growth of the nation's overall economy and many of the benefits of the American system, including vast research and invention would be impossible without the sponsorship of large business organizations.

Atomic energy and utilities

A more technical side of the industry was discussed by John W. Landis, assistant manager of the Atomic Energy Division, Babcock and Wilcox Co., Lynchburg, Va., who reported on recent progress in the development of atomic power by privately-owned electric utilities. He described several large atomic power plants now under construction, including the Dresden and Indian Point installations, pointing out that private industry has made much more progress in the atomic field than the public realizes. He said the research and development programs of such manufacturers as General Electric and Westinghouse working with various electric utility companies offer the best promise of making economic atomic power generally available within the foreseeable future.

The delegates also heard reports of the Association's activities in the fields of accident prevention, sales, and rural development and they adopted a new public information program designed by the public relations committee. The new program will involve gathering and distributing to news media information on over-all utility industry matters in the two states.

Officers elected

Hugh D. Stillman, division manager, Appalachian Power Co., Huntington, W. Va., was elected president of the Association. He succeeds John C. Parrott, president, Roanoke Gas Co., Roanoke, Va.

Other officers elected were H. Atwood Hitch, vice president, Virginia Electric and Power Co., Richmond, Va., as first vice president; Eric C. Summers, executive vice president, Monogahela Power Co., Fairmont, W. Va., as second vice president; W. F. Keehne, assistant treasurer, Appalachian Power Co., Roanoke, Va., as treasurer; and A. T. Ellett, secretary-treasurer, Roanoke Gas Co., Roanoke, Va., as assistant treasurer.

Washington churches

(Continued from page 27)

valuable space was saved over that necessary for a central heating system.

When you consider that the ten heat pump units needed a total of only 125 square feet (12.5 square feet per unit) and that this space did not require a fireproof room with thick fireproof walls and ceilings, and a large chimney, the heat pump takes on stature. Pilgrim uses their equipment rooms for mimeograph production work, and general church storage.

The flexibility of the heat pump is one of its principal assets. We had the opportunity to outline and

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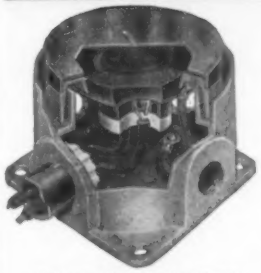

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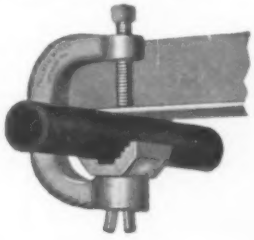

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plan the entire building at Pilgrim and its interior, and then fit in the heating and cooling plant to suit. Heat pumps can be placed anywhere from basement to attic including a crawl space or roof location, if necessary. The floor plans showing the convenient location for the heat pumps at Pilgrim are shown in accompanying illustrations.

Our overall master plan for this church was such that only one half was built at this time. By using heat pumps, only the necessary heating and cooling for the present structure was purchased. By comparison, a central system would have meant that space and capacity of the equipment would have had to be such as to provide for an entire total plant when and if needed.

This could have been five years in the future, and yet, the capital investment would have been much greater at this time to provide heating and cooling. In addition, the heating and cooling equipment would have been much larger than necessary. Consequently, the efficiencies of the equipment would have been lower and the operating costs would have been greater. When the next and final increment is planned for this building, the needed heat pumps of proper size to accommodate only that increment, will be added to fulfill those requirements.

By using these heat pumps in more than one group, the necessary duct work for supply and return was reduced in size and located where its appearance did not cause objections. In this particular instance, for the worship sanctuary, they were placed on the roof entirely out of sight.

The capital cost to install this heating and cooling plant was less by using the heat pumps than it would have been with the so-called conventional system, thus saving capital, which was borrowed, together with the interest. It satisfied the Congregation because it was *most for the money*. In this instance, the church building committee estimated the savings as approximately $15,000.00.

The physical dimensions for both floors gave a total volume for use at 190,000 cubic feet, and it was built and equipped and furnished for $0.89 per cubic foot, which speaks for itself. Equipment included a complete electric kitchen, and also total electric capacity for doubling the electric kilowatt connected load when the school and social hall increment are needed in the future.

Leg-saving service

(Continued from page 34)

actually do, they'd be very apt to discover that on an equable basis, their overhead exceeds that of a shop working six men and six trucks.

"Operating under this rosy delusion, end of the year finds the small and uncalculating contractor winding up with a net profit that hasn't exceeded the wages earned previously as a journeyman.

"The sad part of this sorry situation is that such men have in the meantime, knocked the props out from under legitimate business. According to their lights, they're busy. Sure they are. They've taken some wiring jobs at starvation wages and they're getting the work all right. But they've become poor credit risks in the interim.

"The supply house that lets such contractors snowball their credit is doing its customers a disservice.

"Assuming the contractor partnership owns a modest capital and something turns up that depletes their cash reserves, they're quite apt to wheedle an advance payment on a new job in order to help square accounts with their wholesaler. Thus there has always to be a succession of more and new jobs in a "rob Peter to pay Paul" fashion.

The wholesaler is thereby contributing to the financial delinquency of his customers in his honest desire to help them. The industry is hurt because price levels are toppled, and it is conceivable that somewhere along the line costs must be boosted to recoup losses, so the public pays.

"Price schedules are dumped overboard into the sea of potential bankruptcy because the unwitting contractor needs more and more work, and he takes this for less and less in order to meet his obligations.

"Such snowballing is highly detrimental to the entire field of contracting. Yet the housewiring jobs which many of these beginning contractors are out to snare should pay better than commercial work which often simmers down to a diminishing and lowly four and five per cent profit category."

Brannon points out that the public must not be short-changed.

"Adequate wiring is a must today," he says. "Why should a $25,000 house have only a 100 amp service when the electrical contractor could upgrade it to 200 amp, thus avoiding penalizing the eventual purchaser of the house and saddling him with later expense in future expansion of his electrical requirements?

"Sure the general contractor's desire is to build so as to assure a maximum profit, but it is up to the contractor to show him the folly of an inadequate wiring installa-

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tion which may later reflect upon his reputation as a builder.

"So what happens? Along comes a brother electrical contractor who underbids and cheapens the material to be used on the job. On the surface, the general contractor thinks he's getting the same caliber job just because it earns a certificate of inspection.

"Thus the contractor operates to his own undoing. He gives away his fixtures; he's more inclined to grade downwards than upwards. In his anxiety to land the job, he assures the customer he doesn't need this and he doesn't need that and this is just as good because it will pass inspection. Result is, everybody suffers."

Brannon feels that wholesalers would do well to deny overextended credit to new contractors of unproven stability. "We are attempting to enlist wholesalers as associate members of our electrical association so they will better understand our problems, and we theirs.

"They could participate in our discussions, present their products to the assembled membership; if any stones are thrown they can throw them back, refute charges, explain away apparent injustices and iron out misunderstandings to our mutual benefit."

Metal surfaces

(Continued from page 51)

thinness or rust spots, repainting is in order. The choice of color is important here since the American Standards Association, after exhaustive studies, has recommended three specific shades of grey paint. In addition, a color which contains aluminum is available to lend added sun-heat reflection. While paint is needed for weather protection, there can be, too, much of a good thing here in so far as building up the heat loss capacity of the transformer. Each coat of paint averages .001 inch in thickness.

Flow coating

The drums, hose, pump, and drip trays used for the stripping operation on transformers can be used for the flow application of paint.

The flow coating consists of pumping the paint to the top of the unit and permitting it to flow down the fins and other projections until they are all well covered. For effective covering, the paint utilized in flow coating should be thinned to 18 to 20 seconds in the viscosity control cup or about 1.2 on the hydrometer.

It is recommended that the pump have no less than 1 inch intake and that discharge lines be equipped with gears rather than the conventional impeller common to centrifugal units. The pump should be of sufficient capacity to provide a flow of approximately 6 to 8 gallons of paint per minute with the pump operating at comparatively slow speed. Experience with rubber vane type impellers in the pump indicates that slightly higher speeds are possible with this unit.

Spray painting

This method is well adapted to reaching complicated assemblies and hard to reach surfaces where brush application is impossible. Extension nozzles get into tight places and the advent of the "Skyworker," a hydraulically operated boom with dual baskets at the extremity gets the men into positions once possible only with expensive staging. Care must be taken to see that paint is not deposited on other buildings, cars, or equipment. Opportune weather plus canvas screens are recommended.

The use of the new synthetic transformer coolants has caused the paint chemists to develop a new line of acid resistive paints. Such paint must be selected to offer maximum protection and resistance against the specific transformer coolant employed and also against the detergents used in the cleaning. Similarly, special paint should be considered for subway transformers. Such vault-installed units must have special coatings capable of withstanding salt, contaminated water, acids, and alkalis prevalent in the air.

Reconditioning substations

With ever widening use of aluminum as electrical substation material there is a decrease of the combating of rust and corrosion problems. For galvanized equipment, we must from time to time perform the task of repainting where the zinc coating has broken down. Periodic inspection and paint-up programs are recommended to catch these conditions before they get out of hand. Two factors determine how well the

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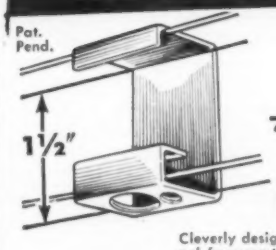

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Code discussion

(Continued from page 75)

ditions since the overcurrent devices are permitted to be set at 125% of full-load current. Hence the motor would not be protected unless three overcurrent protective devices were installed—one in each phase.

Devices which are designed to respond to a drop in voltage would not suffice for protection against single-phasing in such instances because a rotating motor has an almost normal voltage maintained across all of its terminals as a result of the generated voltage in the inactivated circuit.

Tripping devices using CT's

Note 1 following table 28 permits the use of either a series trip in each ungrounded conductor mounted on the circuit-breaker and which carries the full-load current, or tripping devices which are connected to the secondary side of current transformers. Where trip coils are energized from current transformers, instead of carrying full current, two such tripping devices instead of three may be connected to three current transformers provided that the over-all effect is the same; that is, provided that the design is such that an overload in any of the ungrounded conductors will cause the circuit-breaker to open all of the ungrounded conductors.

Note 2 permits a special arrangement for the following systems: 3-wire, 3-phase ungrounded; 3-wire, 3-phase grounded neutral; 3-wire, 3-phase with the mid-point of one phase grounded; and 4-wire, 3-phase grounded neutral. The 4-wire, 3-phase ungrounded neutral is not included in this special provision which permits the secondary tripping device to consist of three current transformers and "two secondary overcurrent tripping devices with a residual current tripping device of a lower range."

The residual trip in such a case has no flow of current and hence does not operate on balanced overloads. If the overloads become excessive, the two secondary overcurrent devices activate the breaker. In the event of a ground, however, the load becomes unbalanced and the residual device trips the breaker. Since it is required to be of a lower rating, it will trip on a ground fault current of lower magnitude than that required to trip the breaker on a balanced overload.

Note 3 following table 28 seldom applies. It is there—just in case. Fortunately, standard protective devices are as readily available as the equipment to be protected. Therefore, it will not be necessary to combine circuit-breakers and fuses in the same protective device and thereby invite wholesale motor burn-outs as a result of single-phasing due to the impracticability of setting circuit-breakers to open at the exact melting point of fuse links.

There are three basic types of overcurrent protective devices

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which are acceptable under Code standards for protection against overcurrents due to short-circuits and ground faults. Each of these basic types can be further divided into many classifications according to the design and operating characteristics of each. The three basic types, however, are the following: (1) fuses, (2) direct action trip circuit-breakers, (3) relays.

Fuses are used on high-voltage as well as on low-voltage systems and are thermally operated. Although less accurate than relays, they are considered by many to be comparable to low-voltage, direct-acting circuit-breakers. The time needed for circuit-clearing action is usually comparable to that required for such low-voltage breakers on high currents, and is usually more rapid than the breakers on low currents. Fuses have the disadvantage of operating singly, leaving other portions of the circuit in operation which could result in burn-outs unless they are otherwise protected.

Direct action trip circuit-breakers include the type supplied by the secondaries of current transformers. On circuits of 600 volts and lower, the series trips usually carry full current. On circuits above 600 volts, the trips are usually connected to secondaries of current transformers. Direct action trips of either type are usually not used on voltages above 2,400.

Some circuit-breakers are adjustable and some are non-adjustable. The non-adjustable type are required to be used on standard branch circuits as defined in Article 210. This non-adjustable feature required by the Code, however, has become a mockery now that some manufacturers have developed 50-ampere breakers which are interchangeable with 15-ampere sizes by the simple procedure of lifting one out and snapping the other in its place. Like fuses, direct action trip breakers are less accurate than relays.

Relays provide the most accurate protection of any of the three basic types of overcurrent protective devices. They are the most expensive and are usually used only on the more expensive equipment. This type of protective system is usually designed by engineers to fit the particular needs of each installation. Relay protective devices are adjustable, not only in regard to current-tripping values, but also in regard to the time element.

These relays are usually connected to the secondaries of potential transformers and current transformers. They can detect direction of current, and if necessary operate on only one of these directions; they can measure line impedance, the distance and direction of a fault, the differences in current values in different portions of a circuit; operate on a predetermined unbalance, a combination of current and potential, or on either of the two separately; or they can function, in the manner of a direct trip or a fuse, on the current magnitude only.

One type of relay (for differential protection) is referred to in section 4424-c of the Code for motor overcurrent protection on circuits of over 600 volts. (See the September issue of ELECTRICAL SOUTH for our discussion of this particular type of relay. See sketches in this issue for possible uses of other types).

In the next issue, we will complete our discussion on over-current protection. After overcurrent protection, we will discuss another very important article of the Code —Grounding.

Answers to Code test questions are as follows: (1. **F** section 2404) (2. **F** sec. 2404) (3. **T** 2404) (4. **F** 2408) (5. **T** 2408) (6. **b** 2408) (7. **c** 2408) (8. **a** 2410) (9. **a** 2411) (10. **a** 2411).

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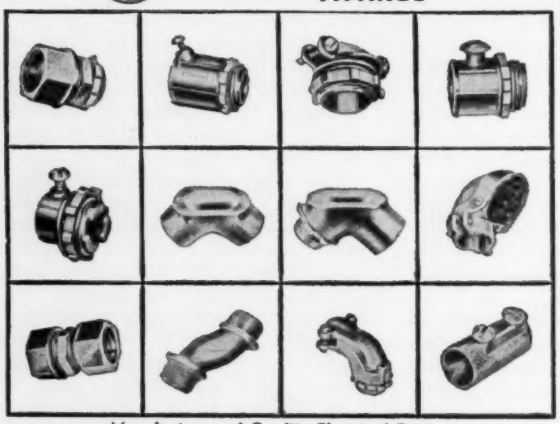

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ADVERTISER'S INDEX

A

Accurate Mfg. Co. 92
Adalet Mfg. Co. 79
Adam Elec. Co., Frank .. 56, 57
All-Steel Equipment, Inc. .. 55
Allis-Chalmers Mfg. Co. 60, 61, 63
American Metal Moulding Co. 96
Appleton Electric Co. 44
Arrow-Hart & Hegeman Elec. Co. 14, 15

B

B & C Metal Stamping Co. 81
Bar-Brook Mfg. Co. 103
Jasper Blackburn Corp. 89
Blackhawk Industries 94
Bulldog Elec. Products Co. ... 33

C

Champion Lamp Works 69
Champion Mfg. Co. 100
Classified Ads 102
Copperweld Steel Co. 71
Crouse-Hinds Co. 21

D

Delta Division Light & Power Utilities Corp. 79
Diamond Wire & Cable Co. ... 43

E

E J S Lighting Corp. 17
Eagle Electric Mfg. Co., Inc. . 95
Elgo Shutter & Mfg. Co. ... 79
Elliott Elec. Products Co. ..102
Estimating Handbooks Associates 93
Evans Metal Co. 98

F

Fanner Mfg. Co., The 16
Federal Pacific Electric Co. .. 13
Fullman Mfg. Co. 99

G

Gedney Elec. Co. .. Second Cover
General Electric Co. Apparatus Dept. 18, 19
General Electric Co. Distribution Assemblies Dept. 6
Gibson Mfg. Co. 73
Graybar Electric Co. 9
Greenlee Tool Co. 85

H

Helwig Company 100
Henderson-Hazel Corp. 97

I

I-T-E Circuit Breaker Co. .....Back Cover

K

Kuhlman Electric Company .. 67

L

Lidseen of North Carolina, Inc. 91
Light & Power Utilities Corp. 2
Lighting Dynamics, Inc. 102

M

M & W Elec. Mfg. Co., Inc. .. 93
Massey, Inc., A. H. 104

N

Nutone, Inc. 5

O

O. Z. Electrical Mfg. Co. 10

P

P-W Industries, Inc. 90
Paranite Wire & Cable Co. ... 8
Perfeclite Co. 7
Phelps Dodge Copper Products Corp. 38
Preformed Line Prods. Co. 40, 41
Progress Mfg. Co. 1
Pyle-National Co. 11

R

Roebling's Sons, Inc., John A. 77
Royal Elec. Co., Inc. 87

S

Simplex Wire & Cable Co. ... 65
Smithcraft Lighting Div. 35
Sorgel Elec. Co. 31
Southwire Company 37
Square D Company .. Third Cover
Stephens, Inc., M. 104

T

Thomas & Betts Co. 20
Tomic Sales & Engineering Co. 101

U

Universal Pole Bracket Corp. *

V

Vulcan Elec. Co. 98

W

Want Ads 102
Weaver Co., J. A. 59
Westinghouse Elec. Corp. 74, 75, 82, 83
Whitney Blake Co. 89

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Following is a list of MANUFACTURERS' AGENTS who represent Advertisers appearing in *this* issue of ELECTRICAL SOUTH. Consult the Advertisers' Index on the preceding page for quick location of ads.

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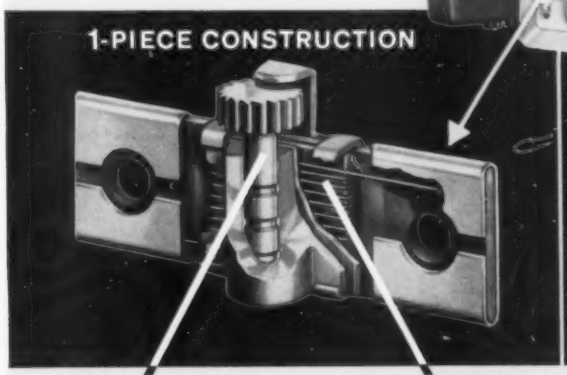

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